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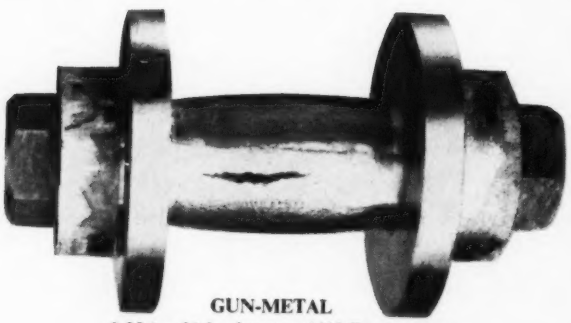
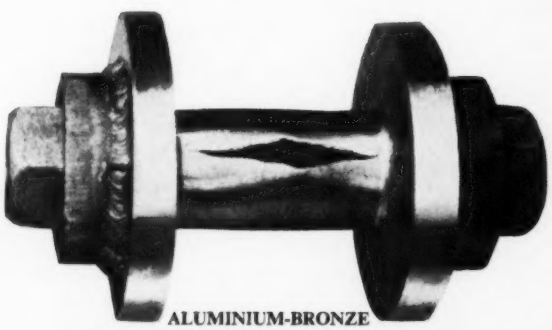


GUN-METAL
0·25 in. thick—burst at 4480 lbs. per sq. in.



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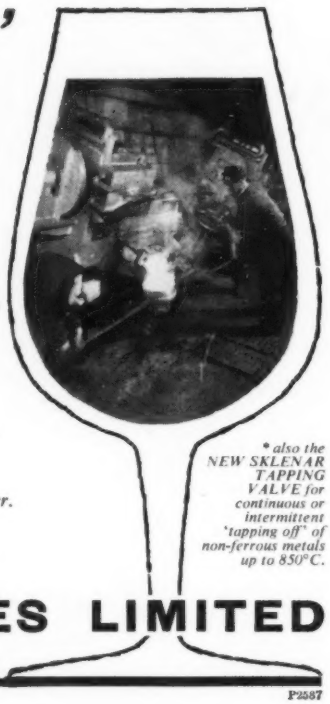

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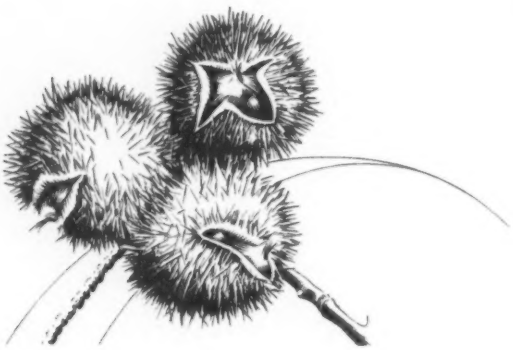

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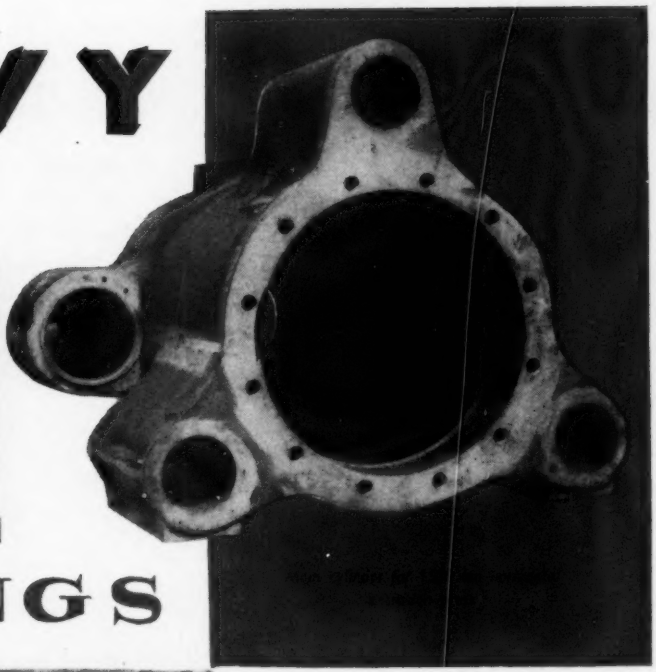

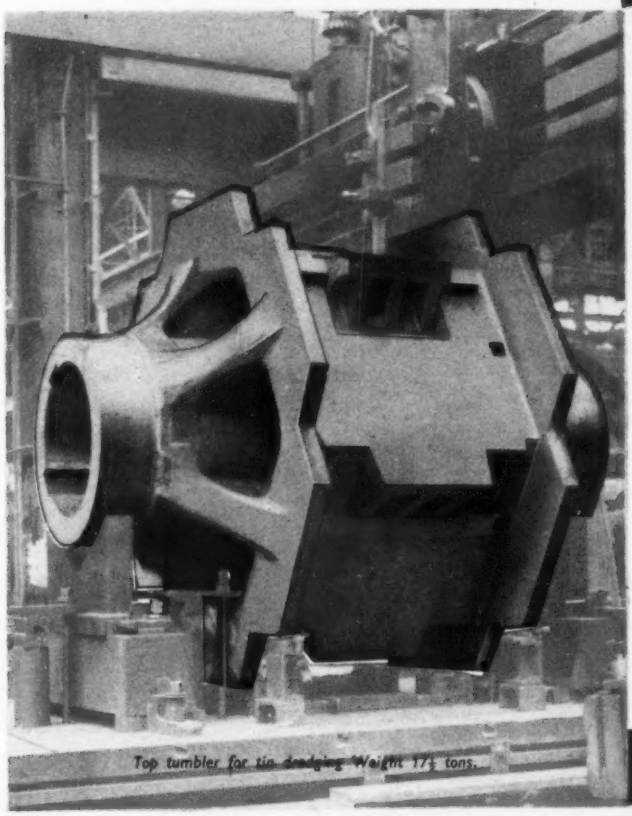

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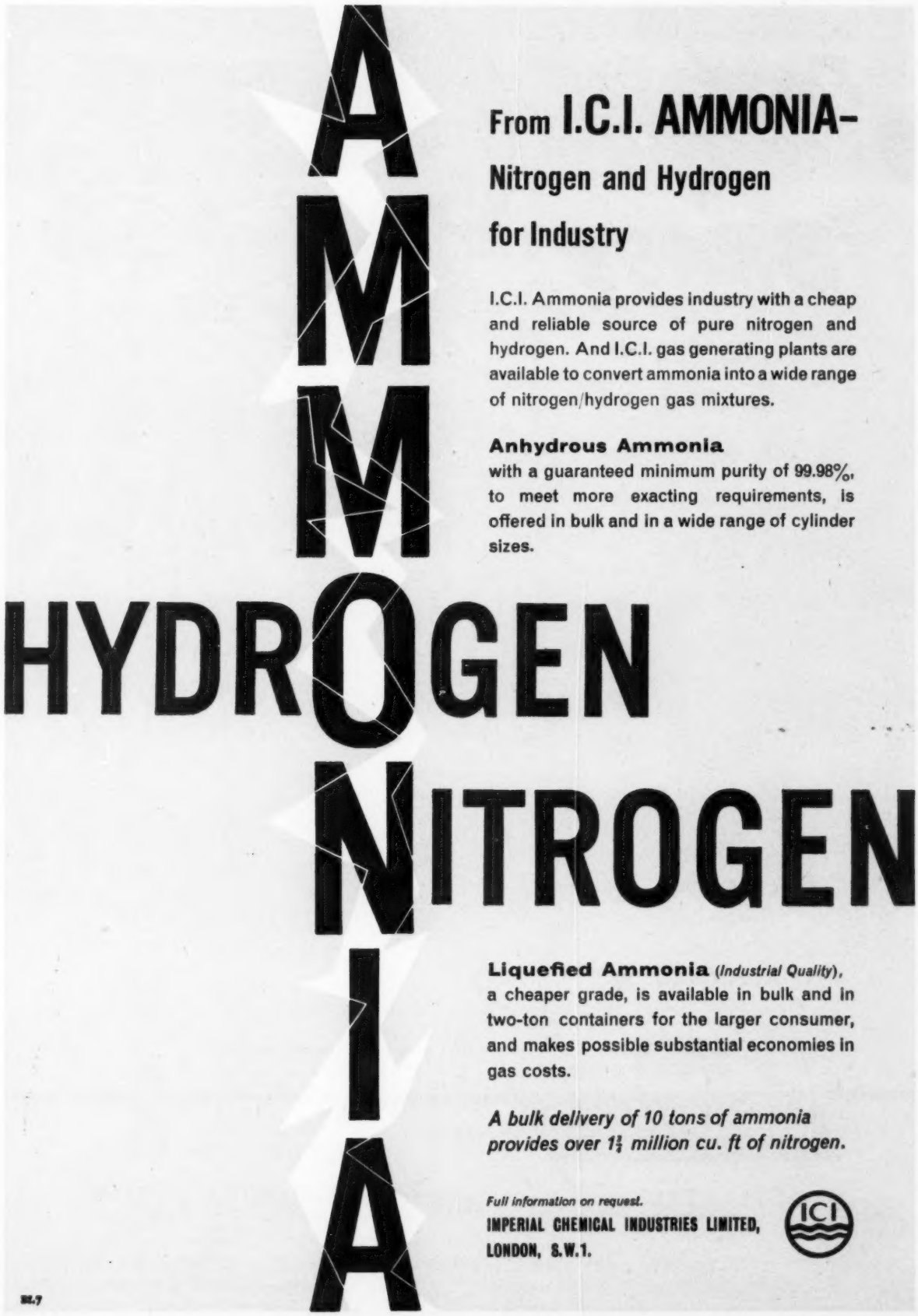

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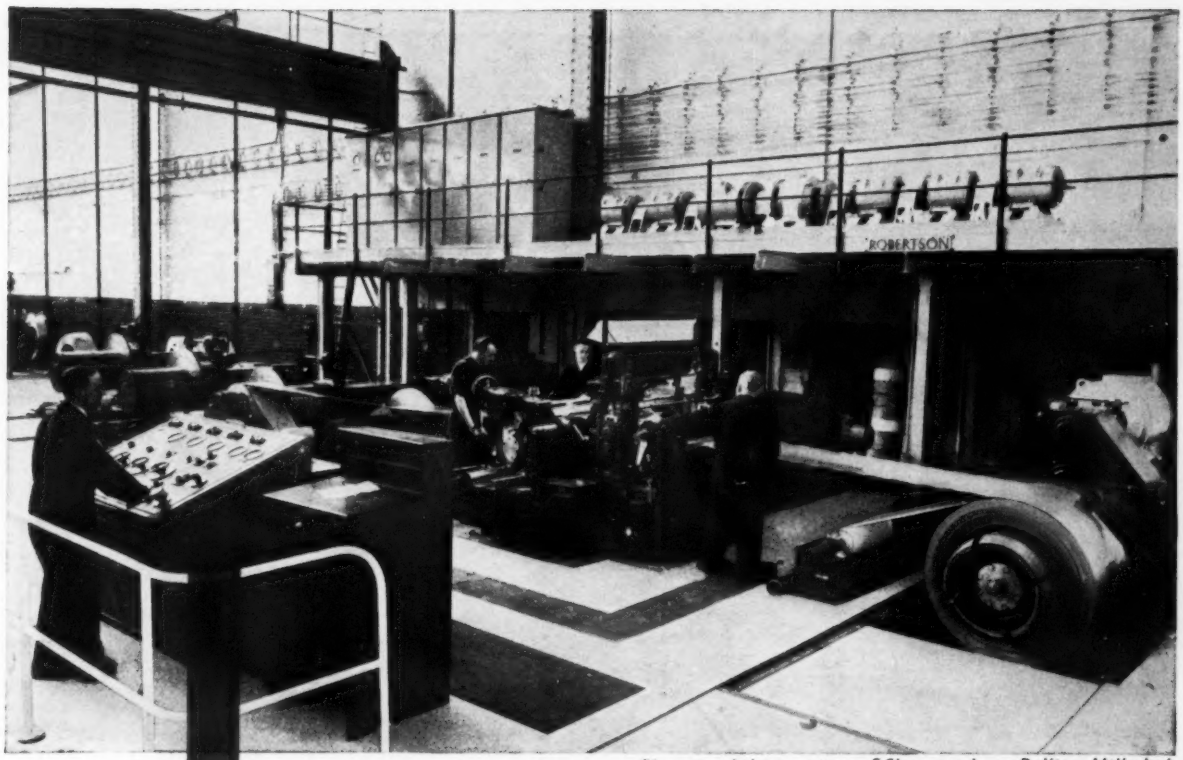

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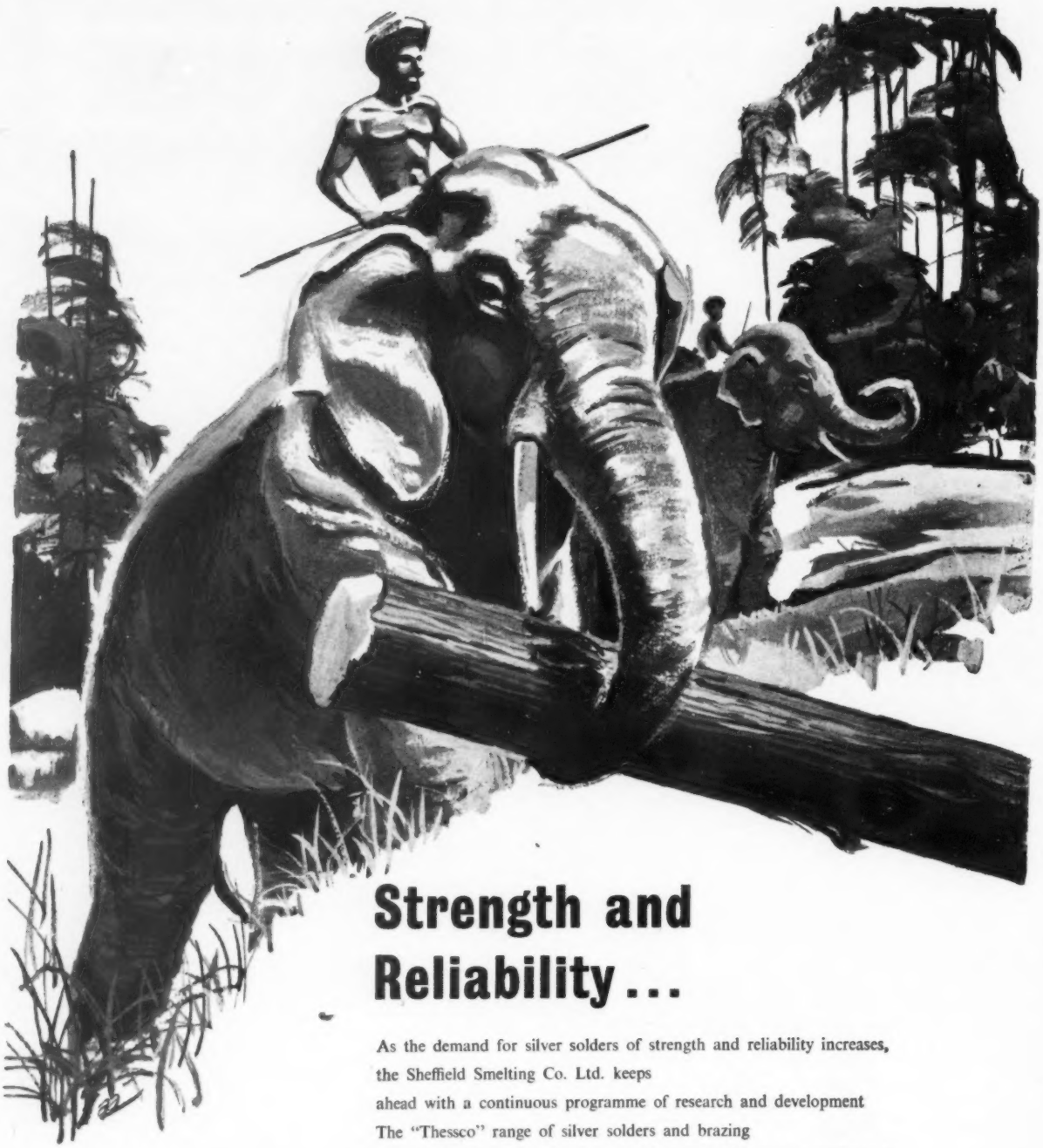

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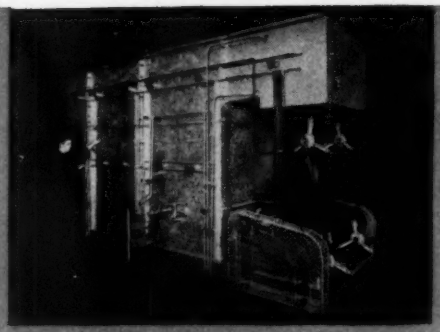

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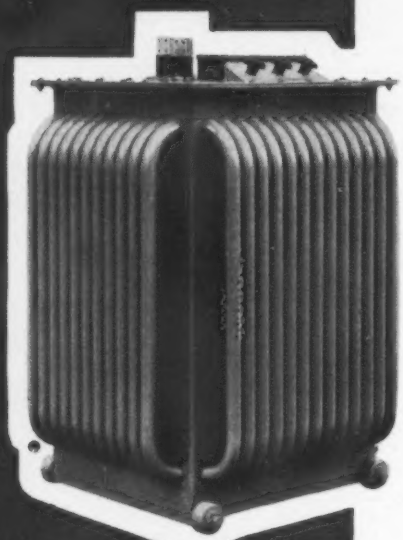

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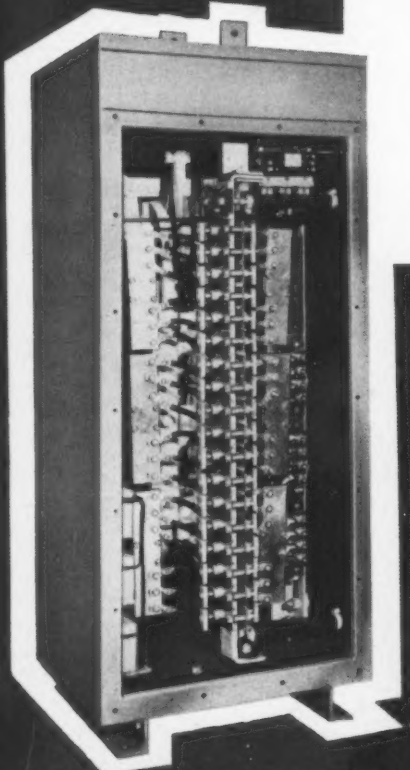

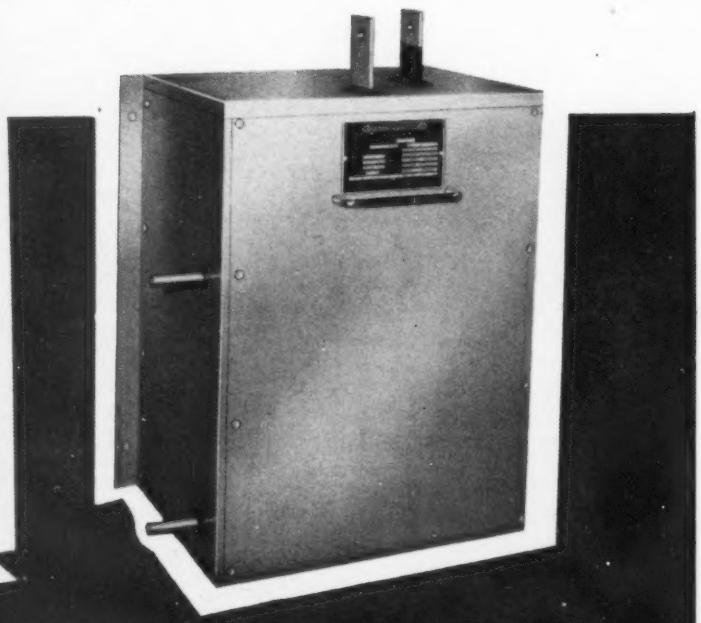

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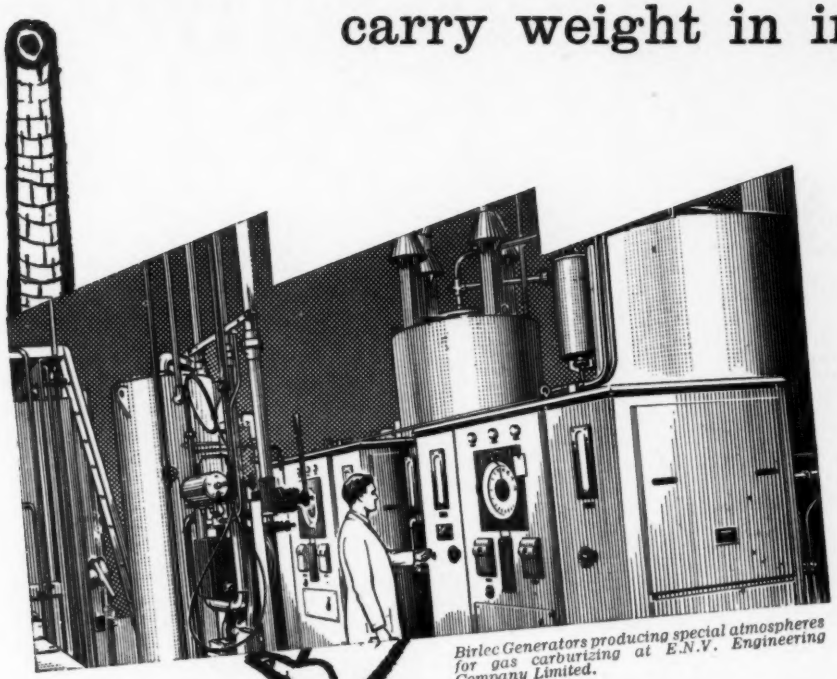

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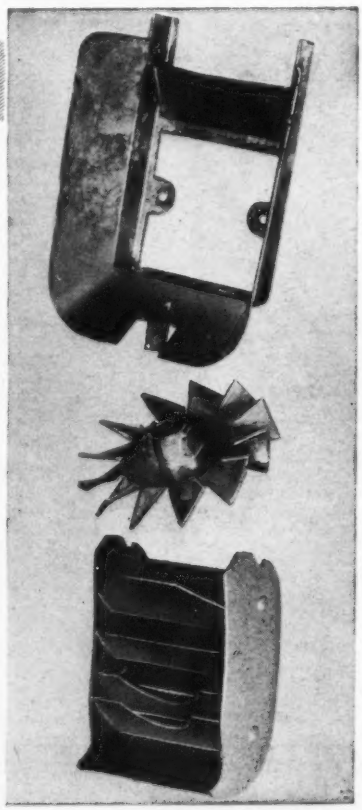

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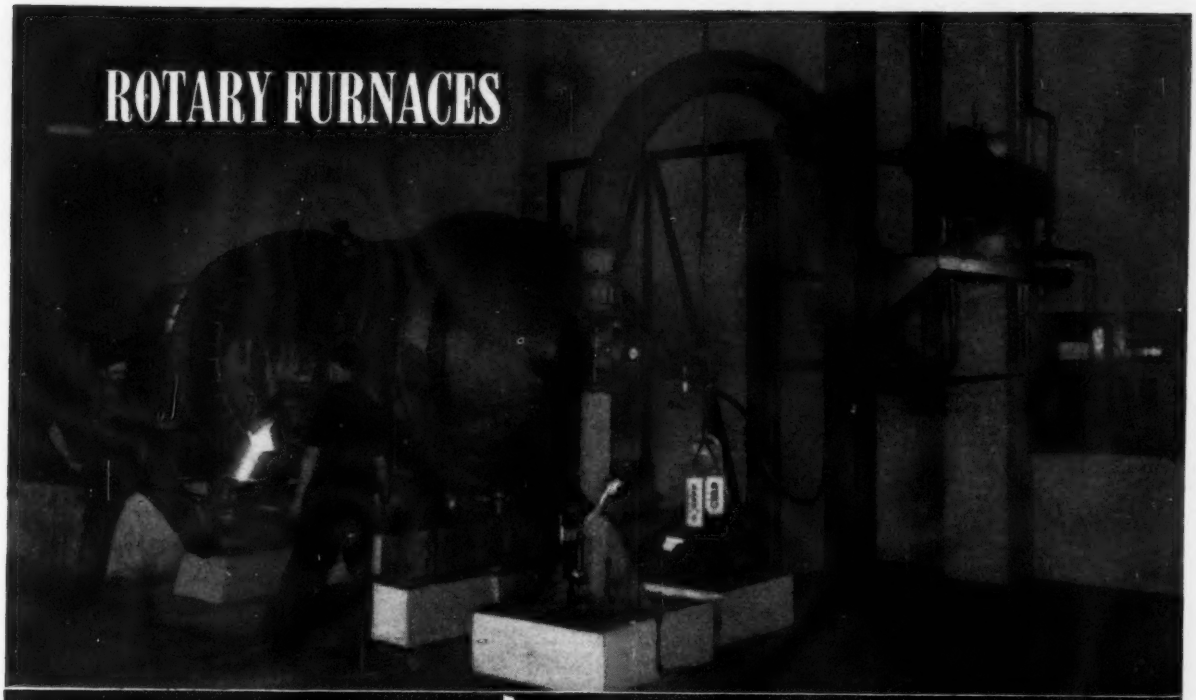

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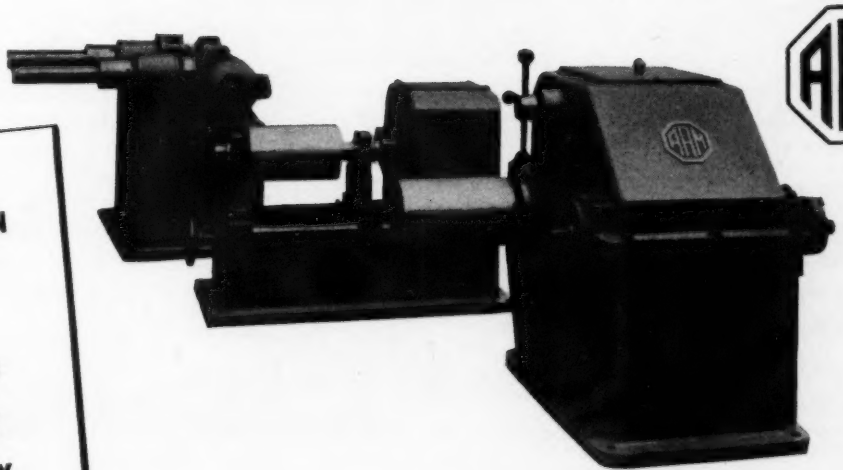

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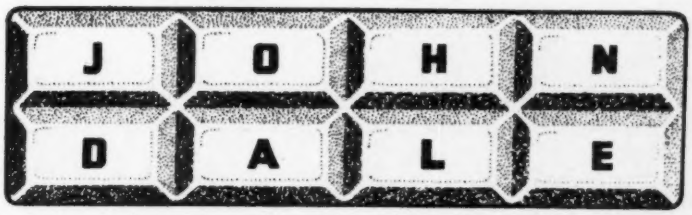

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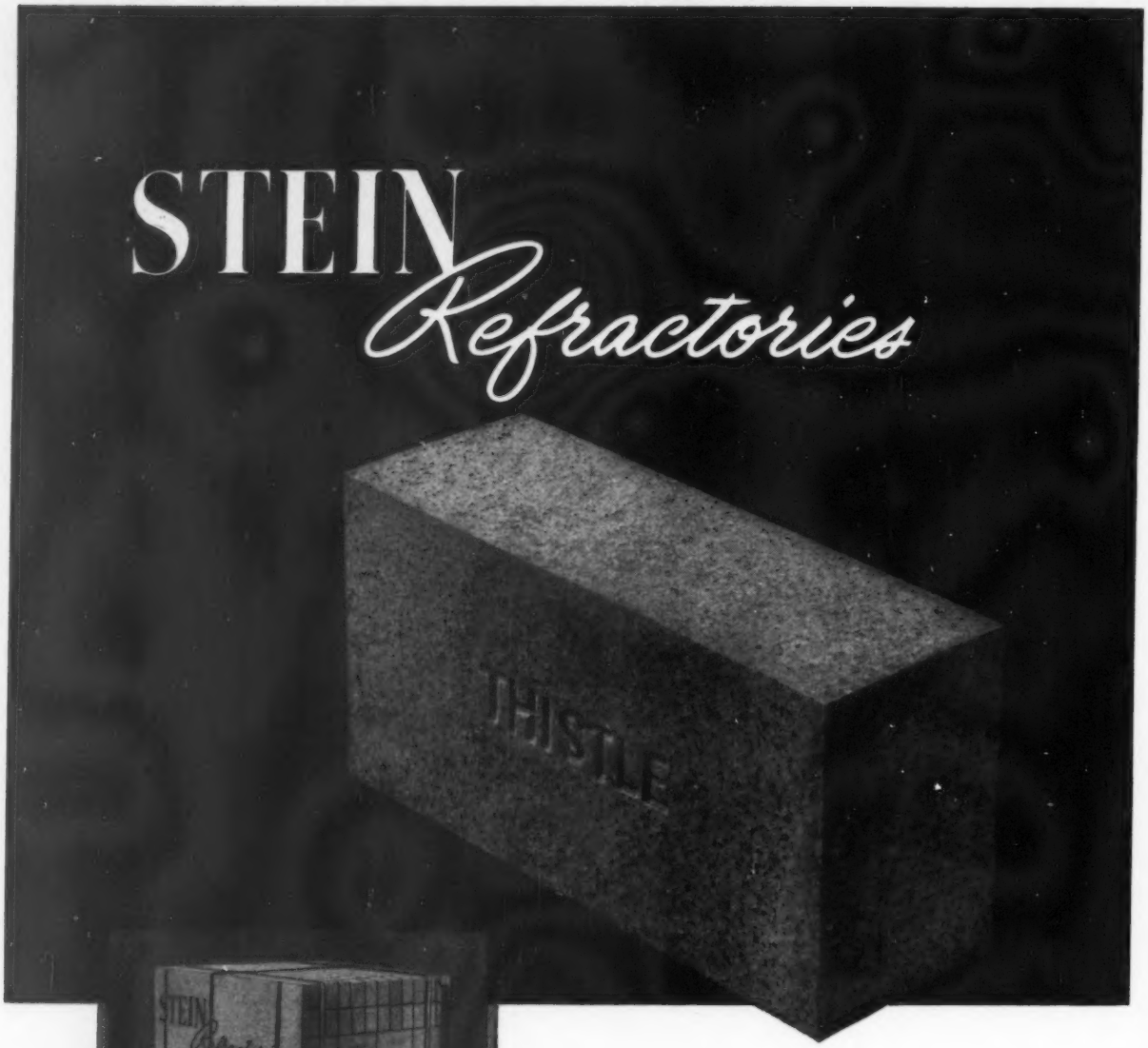

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FOUNDED 1909

EDITOR: L. G. BERESFORD, B.Sc., F.I.M.

9 OCTOBER 1959 VOLUME 95 NUMBER 9

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VOLUME 95 NUMBER 9 9 OCTOBER 1959

Pressing Problems

DEVELOPMENT in the technology of reactor materials is undoubtedly the key to the development of economic nuclear power. In this connection one of the most pressing problems is the provision of fuel elements of high integrity and long burn-up. Based on limited irradiation experience at Windscale and Chalk River, a convention has grown up that uranium metal fuel elements should achieve an average burn-up of 3,000 MW days per ton, and those of uranium oxide an average burn-up of 10,000 MW days per ton. But, as Sir John Cockcroft pointed out in an address to the European Atomic Energy Society Symposium in Stockholm, there is, in large graphite-moderated reactors, often reactivity to spare to take fuel elements up to 4,500 MW days per ton, and the reactivity of the Candu reactor is such as to enable natural oxide fuel elements to be taken up to nearly 10,000 MW days per ton. In both cases the real limits are set by inadequacies in metallurgical development, and although so far metallurgists have said that the two figures are reasonable targets, they cannot turn these targets into firm guarantees.

From experience gained in the operation of full-scale nuclear power stations, and from tests on small samples in research reactors, it has been shown that, in the case of metallic fuel elements, the causes of failure may be divided into two main classes. First, those resulting from faults in manufacture and handling, such as leaky welds, and second, growth phenomena in "cold" fuel elements, leading to strain of the cans and subsequent development of slow leaks. Since the first of these is obviously a matter for the fabricator and inspector, the development of improved inspection techniques would do much to lessen its incidence. The more academic research metallurgist comes into his own on the question of growth phenomena where an understanding of residual preferred orientation in uranium and uranium alloys, and of cavitation phenomena in canning materials, is required.

As temperatures increase, it seems likely that the future of fuel elements lies in the ceramic field but metallurgical problems will still remain. Thus, thermal cycling and its effects on the cans (whether stainless steel, zircalloy or beryllium), particularly when these are thin-walled, will need to be investigated thoroughly. In addition to the effects of irradiation on fissile materials, consideration will have to be given to the effects of irradiation on beryllium if used for cans, and on beryllia if used for moderators or as a fuel diluent in high temperature reactors. With regard to steels for pressure vessels, it will be essential to ensure that the increase of the transition temperature due to fast neutron doses is a modest one, so that the steels, which vary greatly in their characteristics of this kind, will at all times be kept above the transition temperature. Even more attention than at present will also have to be paid to the properties of the welds.

For all these purposes adequate irradiation facilities in materials testing reactors must be available. In this connection, Sir John emphasized the importance of being able to control temperatures to one or two degrees, and of knowing neutron fluxes and spectra with a good degree of accuracy. The United Kingdom has, at the moment, adequate facilities for this purpose. For a time there may be surplus capacity in Europe; no doubt this could be used on a co-operative basis.

Out of the MELTING POT

Granted: But How?

FOR many years, the reported effects of surface active agents on the strength properties of metals used to be treated with reserve. Such effects appeared to depend on the use of single-crystal specimens, the application of special organic compounds, and on the presence of hypothetical microfissures, while the successful duplication of the tests and of the results almost appeared ultimately to require the possession of some personal touch of the same order as the green fingers required for successful gardening. These days are over. To-day, a consideration of the actual mechanisms contributing to the changes in strength brought about by surface active agents can be introduced by the statement that: "The addition of oleic acid to the surface of copper wires effects a five-fold decrease in rupture time at high load and a two- to three-fold increase in initial creep rate" without apparently causing any lifting of eyebrows. Interest in this effect of surface active agents—the Rehbinder effect, so called after its Russian investigator—has accordingly shifted to its mechanism and the possible phenomena concerned:—mechanical and physical interactions between the agent and the natural oxide film on the metal; chemical interactions, e.g. chemical solution of the oxide film; restriction of oxygen access to the surface by a layer of the agent and/or its supporting medium; agent-metal interaction in monolayer dimensions with change of surface-free energy of the metal; catalytic action of the fresh metal surface with the agent and/or its supporting medium, the resulting products then taking part in one or other of the above phenomena. The colour developed by oleic acid-vaseline mixtures applied to creep specimens of copper indicates the occurrence of chemical interaction. That chemical interaction and the exclusion of oxygen play a definite part is also suggested by the ageing time of about 20 minutes which is necessary before the application of the agent and the commencement of the creep test for the Rehbinder effect to manifest itself. These observations do not necessarily rule out the occurrence of the other phenomena, nor, for example, the easier escape of dislocations, after surface films which tended to retain them have been dissolved. Further evidence would, therefore, be most desirable.

Permutable?

ONE of those self-evident distinctions, which on closer examination proves almost impossible to define, is that between material and a finished part or product. It is almost like trying to define the position and velocity of an electron: if you define one, you cannot define the other. The product of one production process may be the material with which another manufacturing process starts in order to convert it into a product or possibly yet another material. The state of affairs is likely to become even more complicated and indefinable by the switching of the stages of the various processes to which materials are commonly subjected on their way to becoming products. Could anything be more confusing, for example, than the switching of finishing treatments, from the position to which they owe their name, to a position from which the "finished" materials (or should it be products?) proceed to various other (finishing?) operations and treatments. The above considerations and, even more so, the above trends, should not be regarded as academic—as semantic quibbles or unnecessary niceties in regard to pointless definitions. Such considerations will be found to lead the way to a point from which a broad view of the changing production and manufacturing scene can be obtained, which view should prove helpful in planning for the future. This tendency of bringing forward the finishing or, if you like, the pre-finishing of materials and products, for example, indicates a trend towards a development which, for obvious reasons, has progressed much further in the "do-it-yourself" field, namely the trend towards finished or semi-finished kits. Academic or not, such considerations can also serve as an introduction to a reappraisal of the assumption that the logical straight line is the best way from raw material to finished product, and the one along which the more and more desirable maximum degree of standardization can, in fact, most readily be applied.

Large and Strong

YET another material—boron—has now been produced in a state and in a form in which it exhibits properties hitherto unattained and unexpected. In addition to these remarkable mechanical properties, an interesting feature of the discovery is the size of the specimens: not microscopic whiskers, but rods of about 1 mm. diameter and several centimetres in length. The boron forming these rods was of the glassy variety. The rods were prepared by the reduction of boron tribromide by hydrogen near a 0·025 mm. diameter tungsten filament heated to incandescence. To begin with, the rods could be flexed considerably at room temperature, and when incandescent, without breaking. Young's modulus was determined from the deflections in three-point bend tests on 1 mm. diameter rods. The value obtained—64×10^6 lb/in^2—indicates that this form of boron is about twice as stiff as steel. The modulus of rupture was determined by mounting the specimen as a cantilever and loading it to fracture. The maximum tensile stress in the surface of the rod at fracture was calculated to be 156 tons/in^2. The strength of two other rods, 1 mm. in diameter, was also determined in tensile tests, in which no special care was taken in mounting the specimens, so that the tensile strength values obtained can be regarded as being minimum values. In these tests the force required to break the tungsten filament on which the boron had been deposited was found to be less than 0·2 per cent of the total force required to break the boron rods. Tensile strengths of 110 and 94 tons/in^2 were obtained on the two samples, giving an average of 102 tons/in^2. The specimens showed no apparent ductility either at room temperature or when incandescent. These very high mechanical properties of this form of boron should be considered in conjunction with the low density (2·3 gm/c.c.), the high melting point (about 2,000°C.) and the relatively high resistance to oxidation of boron. They are thought to be due in part to the lack of surface flaws in the "as prepared" material, and the resistance of the surface to damage during subsequent handling because of the hardness of the material (boron is harder than sapphire) in contrast to the behaviour of, for example, quartz, which is relatively soft.

Skinner

APPLICATIONS AND ADVANTAGES OF INERT CONTOURED AUXILIARY, AND BIPOLAR ANODES

Plating Anodes

By D. J. FISHLOCK

(*Concluded from* METAL INDUSTRY, 2 *October* 1959)

IT is occasionally necessary to use an insoluble anode in plating. This is chiefly the case when either the anode efficiency greatly exceeds the cathode efficiency, as in chromium plating; when the anode's solubility is impracticably low, as in rhodium plating; or when the cost of anodes is excessive, often the case in precious metal plating. In addition, a proportion of inert anodes may be useful to counter excessive anode dissolution and sometimes to accelerate dissolution by galvanic corrosion. Again, it is sometimes desirable to have an anode of constant size and shape, as in plating the inside of tubular products.

Chromium Plating Anodes. The most important use for inert anodes is undoubtedly in chromium plating where, notwithstanding the rather high cost and fragility of sintered chromium anodes, the fact that they would dissolve at 7 to 10 times the rate of cathodic deposition renders their use entirely impracticable. In addition, the very important re-oxidation of tri- to hexa-valent chromium which occurs at the surface of an inert anode would not take place if the anode were soluble. Many attempts have been made to use a proportion of chromium anode together with inert ones, or chromium alloy anodes. Neither system has proved successful, though: the first, largely because chromium anodes are dearer than chromic acid; and the second because large amounts of metallic impurities are introduced, while the corrosion rate of many such alloys is excessive.

The only anodes of commercial significance at present are the lead, lead-tin and lead-antimony ones, although there has been some application of lead-silver ones and lately of a platinum plated titanium anode.

Antimonial lead anodes, containing 5 to 8 per cent antimony, are the first choice, these being much more rigid and offering a greater corrosion resistance to the solution than pure lead ones. The latter, although having good resistance to electrolytic corrosion, tend to corrode rapidly when left unpolarized in the solution and must be removed and rinsed when the bath is idle. Their corrosion resistance is improved, however, by anodizing them in dilute sulphuric acid for 48 hours. This imparts a thick layer of lead peroxide to the surface, this being responsible for the Cr III to Cr IV oxidation. The peroxide film is also formed, of course —although less heavily—in the plating vat. All lead anodes need to be scrubbed frequently to remove the non-conducting lead chromate; this is best done at weekly intervals and with care, so that the underlying peroxide film, which is both protective and conducting, is not removed. It can easily be demonstrated that the more frequently they are cleaned the less is the overall loss in anode weight.

Badly corroded anodes require more drastic treatment, such as mechanical action, but solutions containing chlorides, e.g. conc. NaCl solution acidified with HCl, greatly assist.[14] Another method is to reduce the lead cathodically in an alkaline pyrophosphate solution.[4]

If the anodes are in operation almost continuously, their antimony content may be economically reduced to 0·5 or 1 per cent; *per contra*, the solutions using fluoride catalysts need more resistant anodes bearing 13 to 20 per cent antimony. Also in use are lead-7 per cent tin alloy anodes for which very high corrosion resistance to fluorides is claimed; lead-0·2 per cent tellurium anodes, and silver-lead alloys although costly also have a long life. Quite recently, however, favourable experiments have been made using a titanium anode plated with some 5 millionths of an inch of platinum. This would appear to offer superior strength, conductivity and corrosion resistance to any of the aforementioned

TABLE II—SOME RECOMMENDATIONS IN CHOICE OF ANODES

Metal	Solution	Anode Shape	Anode Type	Bag	Comment
Nickel	Bright (org.)*	Oval bars	Cast Carbon	Cotton-twill	Below *p*H 4·5
	Cobalt-nickel	Oval bars	Depolarized, rolled	Cotton-twill	Maintain adequate c.d.
	Watts	Oval bars	Depolarized, rolled	Cotton-twill	Maintain adequate c.d.
Copper	Acid	Bars or plates	Cast, oxygen free	(None) or nylon	Pb for inert anodes
	Rochelle	Balls or bars	Rolled high purity	Nylon (if needed)	Some steel often needed
Tin	Stannate	4 in. strips or bars	Cast	None	max. c.d. 20 to 30 amp/ft² Maintain yellow film
	Acid	Bars or plates	Cast	None	[6] High efficiency advisable.
Speculum	Stannate/cyanide	Oval; separate anodes	Electrolytic Cu; Cast Sn	None	[7] Dual anode circuit
Tin-nickel	Chloride/fluoride	Plates	72 : 28 cast Sn : Ni	Nylon or terylene	[7] Also separate anodes
Tin-zinc	Stannate/cyanide	4 in. wide (max.) strip or oval	75 : 25 cast Sn : Zn	None	[8] Anodes must be kept filmed
Cadmium	Cyanide	Balls in iron cage	Pure cast Cd	None	10 per cent of nickel plated steel to reduce anode eff.
Zinc	Bright cyanide	Balls in steel cages	Pure cast Zn	Nylon	Remove when not in use
	Dull cyanide	Balls in steel cages	Pure cast Zn	None	5 to 10 per cent steel to accelerate anode corrosion
	Acid	Oval bars	Extruded or cast	None	—
Chromium	Chromic/sulphate	Strip or round section	Cored, 6 to 8 per cent Sb	None	Anodize before use
	Fluoride catalyzed	Strip or round section	Cored, 7 per cent Sn	None	Anodize before use
Silver	Cyanide	Plates, balls or hemispheres	Cast or wrought, and annealed	Nylon	High purity essential 99·97 per cent +
Gold	Cyanide	Plates	Gold, platinum or stainless steel	None	Remove gold anodes when not polarized
Rhodium	Acid sulphate or phosphate	Plates	Platinum	None	Completely inert

* *Vendors recommendations should be heeded, however.*

[Courtesy Metachemical Processes Ltd.

Fig. 7—High-purity carbon tampons of various shapes and sizes equipped for water-cooling are used in the Dalic brush plating technique

alloys, while its lightness would also prove a major asset (*vide infra*).

The design of chromium anodes has attracted much attention since they tend to creep severely in length at high solution temperatures, while their conductivity is poor for the currents they are required to handle. Anodes with heavy reinforcement at the bottom, along edges and at the solution level, and with heavy gauge hooks—preferably insulated at the join—are now commonplace. More recent developments have included "cored" anodes in which the lead is cast, extruded or electrodeposited around a steel, copper and, lately, aluminium rod to improve its rigidity and conductivity. Again, the titanium anode, if adopted, will obviate such expedients. Cored anodes of considerable magnitude were described by Hammond[15] in connection with the plating of large gun barrels. These were up to 28 ft. long and were required to approach nearly perfect straightness. To measure the deviation, a cathetometer mounted in a lift running the length of the anode was developed, and using a 0·9 per cent cadmium copper alloy core a maximum bow of less than 0·05 in. on a 20 ft × 1½ in. diameter anode was eventually secured. A point of interest in the use of these anodes is that if the very heavy currents used are applied suddenly they flex or bow (a phenomenon termed anode "kick") and may short with the gun barrel. They are, therefore, installed under tension.

Finally, there remains much still to be learned about the corrosion mechanisms in chromium electrolytes, and largely inexplicable failures are even today not uncommon. These may be due to faulty composition, stresses within the alloy or poor distribution of certain constituents, or some entirely unconnected abberation.

Miscellaneous Inert Anodes. Many materials can be used as inert anodes in specific circumstances. Examples include the use of a few steel anodes, nickel plated for preference, in cadmium solutions to reduce the anode efficiency to 95 per cent and thus balance that at the cathode; and in zinc cyanide solutions to improve the corrosion of the zinc by galvanic corrosion (5 to 10 per cent steel). Lead and lead alloy anodes are quite often used, as are stainless steel ones, e.g., for precious metal plating where the cost of large anodes can be prohibitive. Platinum, although inordinately costly, is useful for throwing plating into small holes, etc., and in rhodium plating proves one of the most inert materials, while silicon-iron is yet another. Two types deserve especial mention, though, these being the graphite or carbon ones, and the very recent platinum: titanium ones.

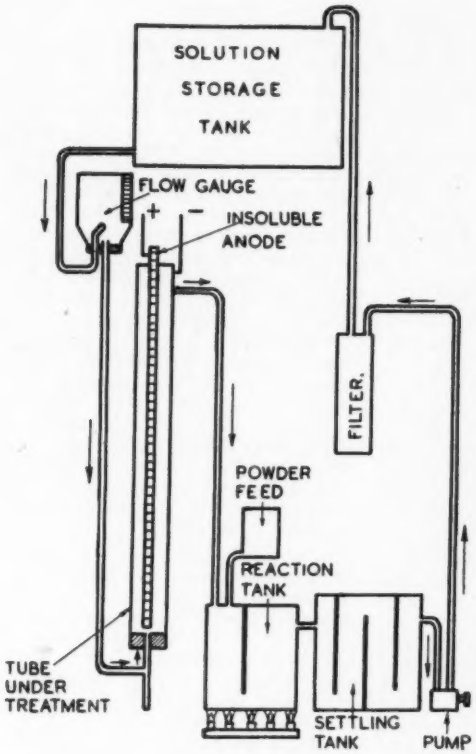
Several types of carbon anode are in general use, including those made from plates of graphite, from amorphous coal and from coke. The latter, for instance, are formed by bonding commercially pure coke particles under high pressure with pitch. After baking, the anode is exposed in an electric furnace to a temperature high enough to convert all non-volatile carbon to graphite. Such an anode contains about 99 per cent graphitic carbon and, as a result, its chemical and mechanical disintegration is very slow. It is inert to all elements, including the halogens, with the sole exception of nascent oxygen; its conductivity is high and erosion in agitated electrolytes slight. Such anodes can find applications in almost any plating or related solution, except the chromium electrolyte, their chief drawback being an inevitable fragility.

A unique application for carbon anodes occurs in the Dalic brush plating process[16], in which very high purity graphite anodes are employed. Although brittle, these score over anodes of the metal being plated on such points as their high conductivity, necessary for the very heavy current densities used; their electro-chemical stability; and the absence of any tendency for them to form poorly-conducting surface films. These anodes are water-cooled in all but the smallest sizes (Fig. 7).

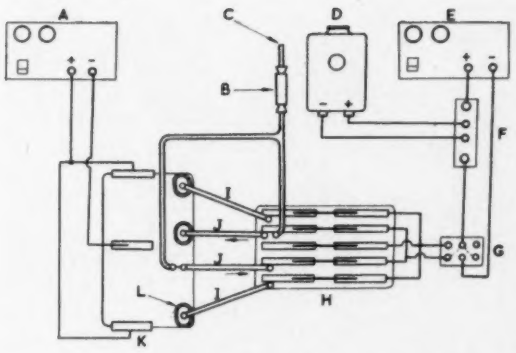
Titanium anodes are a largely unexplored outlet for this extremely corrosion-resistant metal, the latter attribute being due to its natural protective oxide coating. In some non-oxidizing acids, however, the oxide dissolves and corrosion ensues. Early work[17] concentrated on coupling the metal with a more noble cathodic element, e.g., carbon or platinum, and a D.C. of 1·5 V proved effective in combating corrosion in most non-oxidizing acids—in some instances, such as H_2SO_4, reducing it to infinitesimal proportions. Later, it was demonstrated that the polarization could be achieved more conveniently by plating the titanium with a very thin and porous platinum film some 0·005 mil deep.[18] It is interesting to note that there is no significant corrosion in solutions inimicable to titanium even at the discontinuities. This type of anode has proved very impressive in laboratory trials, and two important industrial applications are currently being evaluated: one is as a non-corroding anode for the cathodic protection of steel in sea water or salty soils; the other is as an anode for chromium plating electrolytes which offers solutions to almost all the limitations of existing ones.

Insoluble Anodes for Nickel Solutions. There are material advantages to be gained from conducting some plating operations with insoluble anodes, cardinal ones including the fixed anode shape and anode: cathode spacing, and the salutary influence in terms of both agitation and oxidizing action, of the large volumes of oxygen liberated. Two instances of where such advantages can be used to full effect are in continuous plating of strip, wire, etc., and in the plating of tube bores.

A particularly good illustration is the development of a process for depositing thick, very high-grade nickel on the insides of long, small bore tubes for chemical engineering applications.[19] Other than for the reasons given above insoluble anodes were used here because (a) in the confines of the tube anode particles inevitably released from a soluble anode were found not only to cause rough, physically unsound deposits but the nodules which formed grew so fast that they caused shorts;



Left: Fig. 8—Diagram of solution circuit for nickel plating with an insoluble anode, based on solution regeneration with nickelous hydroxide



Right: Fig. 9—Diagram of solution circuit for regenerating a nickel electrolyte electrochemically, using periodic current reversals to overcome anode passivity

A—Rectifier. B—Filter. C—Compressed air. D—Integrator. E—Rectifier. F—30 amp 50 MV shunt. G—Current reverser. H—Nickel regenerating cell. I—Syphon. J—Air lift. K—Plating cell. L—Filter bag.

(b) the anode area must be of appreciably smaller diameter and, therefore, surface area than the cathode and passivity ensues; (c) the anode cost is high, and its dimensions and positioning are critical; and (d) soluble anodes are not compatible with the vital reverse current etching pretreatment.

Insoluble anodes of pure lead and 1 per cent silver-lead alloy were chosen for the short and medium length tubes respectively, and lead-plated steel or nickel rods for anodes longer than 5 ft. At least 5 mil, and preferably 10 mil, lead coatings were deemed necessary, with a 10-20 mil nickel undercoat on steel. The lead develops a highly conductive brown lead peroxide film during plating, which, provided it is occasionally scoured to prevent loose flakes sloughing off, does not interfere with the plating.

The solution was simplified by the omission of chloride ions, normally needed to counter anode passivity; it comprised:—

Nickel sulphate	..	240 gm/L
Sodium sulphate	..	20 „
Boric acid	..	30 „

Its *p*H will, naturally, fall rapidly as it becomes depleted of nickel ions, and a continuous regeneration system is essential. This was based on nickelous hydroxide additions (0·03 to 0·04 gm/min/amp), since the only practicable alternative, nickel carbonate, introduces the inimical gas CO_2 into the solution leading to stressed brittle deposits. High purity hydroxide powder is thus introduced, most conveniently into a regeneration system as shown in Fig. 8. The acidity of the solution, although not critical, is advisedly maintained below *p*H 3 (incoming) and kept as constant as possible throughout the length of the tube by adjusting the rate of flow.

Other salient operating details for this process include a solution temperature of 35°C. in the tube, and a current density of 12-20 amp/ft^2, depending on the tube's dimensions. In this way, smooth nickel deposits with V.P.H. of about 200, an elongation of some 30 per cent and an U.T.S. of 30 tons/in^2 could be built up to 0·5 in. if required.

Another approach to the problem of regeneration consists of separate electrolytic replenishment using nickel electrodes and a chloride-free electrolyte. A marked difference in the anode and cathode efficiencies can be arranged, but the problem of anode passivity arises. This problem is overcome by taking advantage of the short delay before the onset of passivity and using periodic current reversals to maintain the anodic electrode at 100 per cent efficiency[20] (Fig. 9).

Although not widely practised, since it is clearly more convenient and economical for most plating processes to use soluble anodes notwithstanding their many limitations, inert anode plating can be seen to offer marked advantages in certain instances. Another which might be mentioned is the occasional use of steel or nickel plated anodes for high-speed tin plating from the stannate solution.[21] Tin anodes must be worked within fairly narrow current density limits if the metal is to dissolve as stannate. At high current densities, e.g. above 35 amp/ft^2, the anode darkens in colour and its efficiency falls. Continuous replenishment is based on anodic regeneration.

Throwing power and metal distribution limitations present one of the most troublesome aspects of plating practice —particularly from acid and simple salt solutions. They can sometimes be economically mitigated by using a shaped anode, or a bipolar anode affixed to the plating jig.

Contoured anodes. These, although the most successful method of obtaining a uniform deposit in solutions of poor throwing power, prove unwontedly costly in practice. Cast anodes are usually needed, while scrap loss is high and bagging is impracticable. Much more successful have been attempts to arrange normally-shaped anodes to conform with the contours of the work. Twin anode bars each side of the cathode assist in some instances. Another approach, used in the printing trade, is to suspend bar or strip anodes horizontally in curved, lead-covered slings to follow the curvature of the printing cylinder. Again, by using selective-cell plating, the anodes can be arranged around all walls of the cell if needed; this has been used for the automatic plating of large bumper bars.

Auxiliary anodes are widely used, especially in hard chromium plating and electroforming. The auxiliary anodes are usually connected by a flexible lead to the positive supply, but arranged to carry only a calculated proportion of the current because of their usually close proximity to the cathode; this can be effected through the anode's resistivity. Occasionally, however, it is expedient to operate auxiliary anodes from a separate anode supply. Fig. 10 illustrates a jig incorporating stainless steel auxiliary anodes for internal chromium plating. Typical applications are for plating concave and large flat surfaces, and, of course, deep recesses.

Bipolar anodes. Bipolarity arises through the inclination of the plating current to take a lower resistance metallic path through the solution if one is available than to traverse the

Fig. 10—Designed and built by Newton Plating Jigs and Insulations Ltd., this bright chromium plating jig has a separate bank of stainless steel auxiliary anodes which throw plate into the interior of the dished components

relatively high-resistance electrolyte. Metal will begin to deposit on uninsulated metal work—frequently the tank walls—near the anode, which thus becomes an induced cathode; there will then arise an equivalent tendency to the tank wall nearest the cathode to corrode anodically. The phenomenon is easily demonstrated by floating a thin-walled, water-tight copper drum just below the surface of an acid copper electrolyte by carefully adjusting the electrolyte's density.

When current is applied between the two electrodes a slow rotation occurs, due to deposition on one side and dissolution from the other. The principle is also used in series copper refining.

In order to utilize the phenomenon to improve the distribution of an electrodeposit, the plating jig is constructed with a collecting plate located near the anodes. This picks up the current and conducts it through an insulated connector to the bipolar anode, which is located in, for instance, a concave portion of the cathode surface; thus a higher proportion of the current is "shorted" to this region. The deposit thickness can be controlled by the size and resistivity of the anode and the collecting plate. A soluble bipolar anode may be used, but if its shape is complex to conform with an irregular contour an inert anode is more convenient. Such a system is eminently practicable in both manual and automatic plants.

It is hoped that this article will have helped to emphasize the significance of anodes and anodic reactions in any plating process, these paralleling the importance of the deposition mechanism itself. Much progress has been made in recent years towards improved anodes, this progress having been catalyzed by metal restrictions and high prices. There remains an enormous field still to be explored, however; optimum anode shapes, sizes, compositions and structures for different plating electrolytes remain far from fully classifiable. Some of the directions in which development is still urgently needed have recently been mentioned by James.[22] On the theoretical side, investigations into anodic reactions are currently in progress in several universities, particularly in Britain, and their results will surely contribute to fewer plating problems in the future.

Acknowledgment. British Crown Copyright reserved; Fig. 8 reproduced by permission of the Controller of Her Britannic Majesty's Stationery Office.

References

14 E. R. Thews; *Met. Ind.*, 1947, **71**, 343.
15 R. A. F. Hammond; *Trans. Inst. Met. Finishing*, 1957, **34**, 83.
16 H. D. Hughes; *Trans. Inst. Met. Finishing*, 1956, **33**, 424.
17 J. B. Cotton; *Chem. and Ind.*, 1958, 68.
18 J. B. Cotton; *Chem. and Ind.*, 1958, 492.
19 A. W. Hothersall and G. E. Gardam; *J. Electrodepositors' Tech. Soc.*, 1951, **27**, 181.
20 W. A. Wesley, *et al; Plating*, 1951, Dec,. 1243.
21 A. W. Hothersall, *et al;* Intern. Tin Research Council Development Pub. A-1.
22 C. James; *Prod. Finishing (U.K.)*, 1956, **9**, No. 5.

Correspondence

Correspondence is invited on any subject considered to be of interest to the non-ferrous metal industry. The Editor accepts no responsibility either for statements made or opinions expressed by correspondents in these columns

Sealing Anodized Aluminium

To the Editor of Metal Industry

SIR,—Having read the article "Sealing Anodized Aluminium" in your issue dated 18th September, it would seem appropriate to compliment Mr. J. M. Kape on a very useful piece of work. In case there are some readers who doubt the necessity of such a test, we can readily show any interested parties the ill effects of bad sealing even on articles only exposed indoors in a mild atmosphere. When badly sealed aluminium is exposed out of doors the uneven, stained and milky appearance of the coating is most unsightly.

In our own work on sealing we have found good correlation between behaviour in the sulphur dioxide-humidity test and results on outdoor exposure, thus confirming the value of this test. We have also checked the results obtained with Mr. Kape's beaker test against our SO_2 humidity test using the solution advocated by Mr. Kape at 10 gm/L Na_2SO_3 and a test temperature of 90°C. for 30 min., and have found the two to give satisfactory comparative results, although, naturally, the SO_2 humidity test is more discriminating.

We can also confirm that hardness or analysis of the mains water used is no adequate guide to its suitability for sealing. Birmingham water gives rise to discoloration of the anodic coating when exposed out of doors, despite its low hardness, whilst Banbury tap water, at 290 p.p.m. hardness, gives fairly satisfactory behaviour. This points to the wisdom of using deionized water for sealing, with arrangements for continuous deionizing, as employed in some recent American installations.

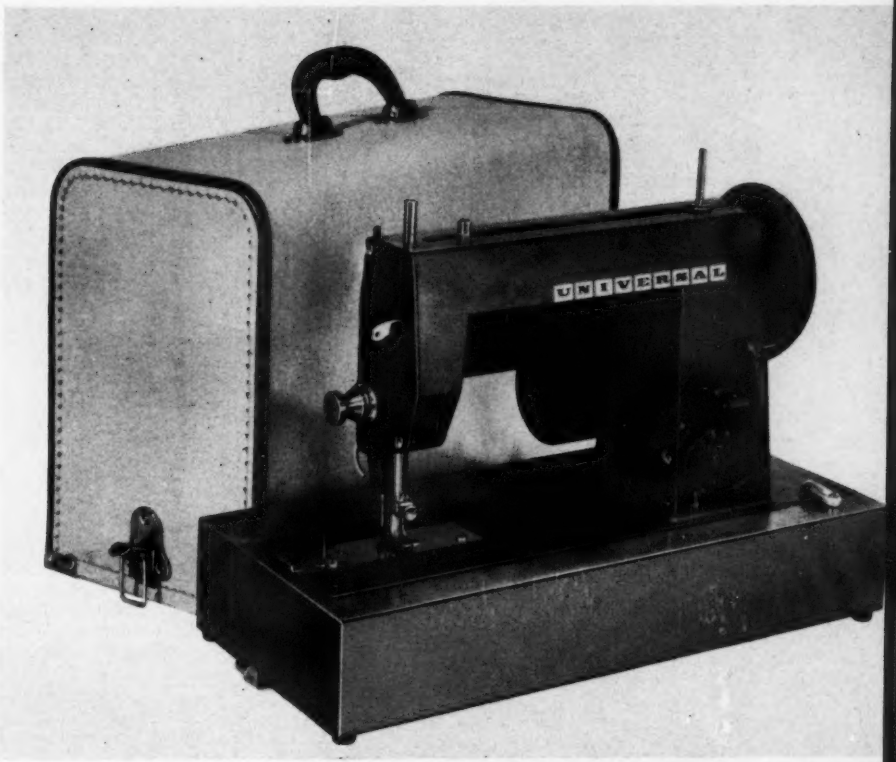
Yours, etc.,
A. W. Brace.
Aluminium Laboratories Limited.

Russian Patents

A REVIEW of Russian patents in many fields, Volume 1B of Derwent "Russian Patents Report" gives brief details of the specifications of some 57 recent developments. A supplementary section gives notes on further patents not printed as full specifications. The Reports are issued twice monthly, at £13 per year, by Derwent Information Service, 54 Tenterden Drive, London, N.W.4.

Die-Casting Review

Simple Die-Cast Sewing Machine



IN the manufacture of sewing machines, pressure die-castings have been widely used for several years, and almost all the leading makers utilize the combination of high strength, light weight and high productivity that such die-castings provide. Probably the most attractive feature of pressure die-cast parts, as the sewing machine manufacturer sees them, is the very slight amount of machining necessary. Elaborate components can be produced that rarely require more than a slight skim to remove taper, and the drilling and tapping of small holes, even where close tolerances are specified.

An entirely new approach to sewing machine manufacture, however, was adopted a few years ago when a machine, designed solely for plain sewing and intended to sell at a price below that of conventional machines, was introduced. This machine, based on a gravity die-cast body, achieved only a limited success, and it was not until the design and tools were taken over by Universal Sewing Machines Ltd., of Hurst Street, Birmingham, that a really simple, sturdy and efficient product was achieved. This new design, basically pressure die-cast, embodies several features different from conventional machines. In particular, the body and base are in one piece, whereas most designs use two separate castings for these parts. Further, the drive from the balance wheel to the shuttle linkage and the needle is transmitted by a single crankshaft or rocker arm.

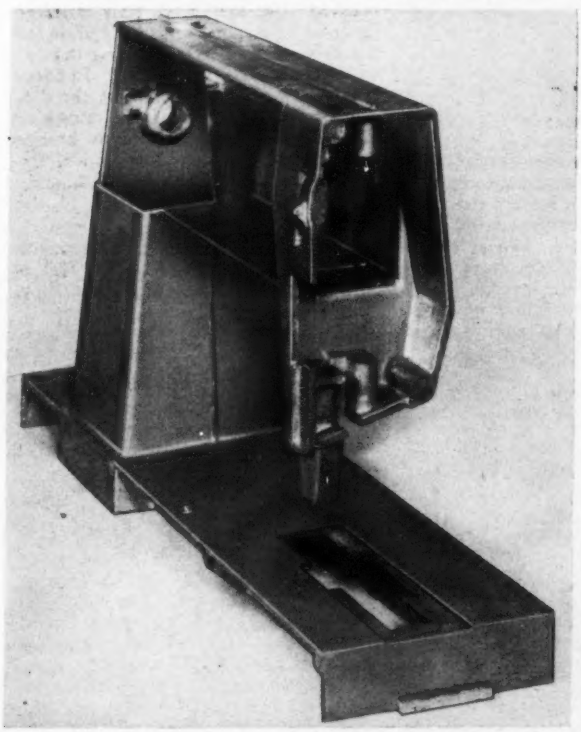


Fig. 1 — The aluminium die-casting for the body of the sewing machine

In the casting for the body, Figs. 1, 2 and 3, strength and simplicity have provided the keynote. The combination of body and base in a single casting has, in fact, made the provision of cast-in detail and coring more difficult, but the additional savings in assembly have outweighed the cost of the complex die-making involved. The casting shown in Fig. 1 is unmachined, and it will be seen that the bearing housing for the balance wheel spindle is cored out, a tapping hole for the crankshaft pivot and a cored aperture for the tension control lever are provided. The remaining bosses around the head of the machine are subsequently drilled, reamed or tapped, 16 of them in a single box jig

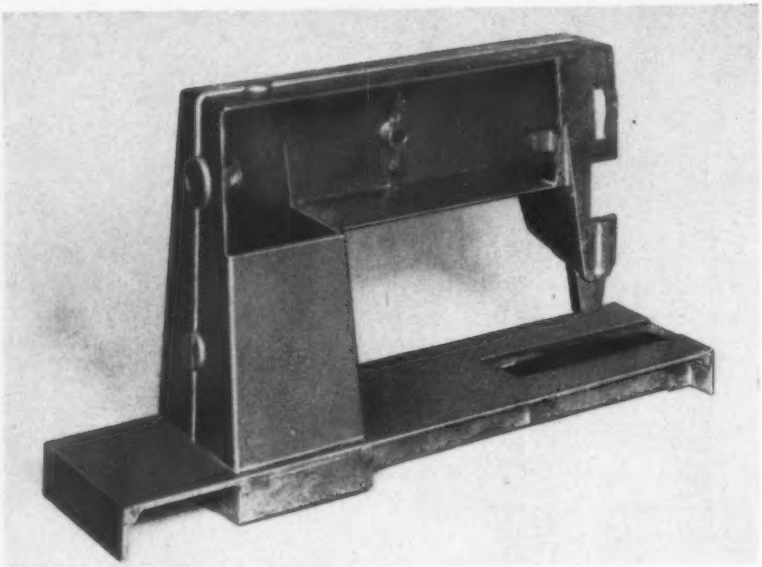


Fig. 2—Rear of the sewing machine body

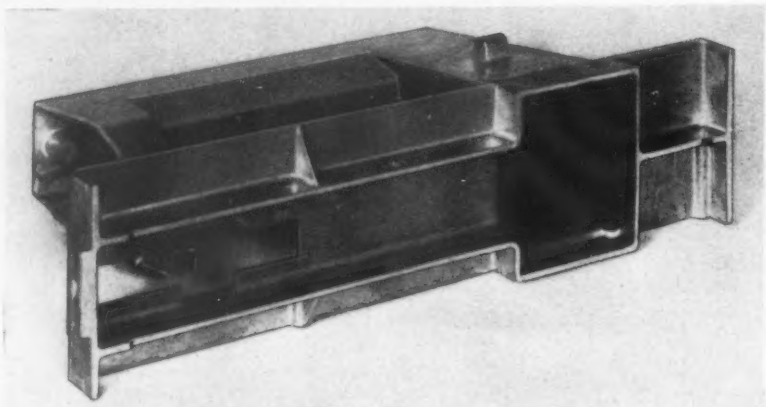


Fig. 3—Underside of the body casting

In this casting the relatively square and box-like forms are in conformation with the trend of current design, and they provide, of course, the opportunity to scale down wall thickness without any loss of rigidity. Indeed, the wall thickness is approximately half of that of the previous gravity cast body. The girder construction of the base, shown in Fig. 3, further indicates how ribs have been used to give strength with lightness. In referring to the box-like and girder forms it is of interest to note that, in spite of the overhang of the head, there is practically no flexing or distortion that can adversely affect the needle position.

From the illustrations it will be observed that the die parting has been maintained along the longitudinal centre line of the casting, and thus, to provide the sections mentioned, cores are drawn in three directions other than normal to the parting. The cores forming the girder construction of the base and the inside of the pillar are necessarily massive, and a further bulky core forms the aperture and bosses within the head. To form the boss for the upper end of the needle spindle, a knock-out core is used, this being dovetailed into the die half that forms the inner side of the body. The loose core is removed after the casting is taken from the die. Because of the heavy core slides, the die for this casting weighs some 4½ tons and is designed for use on an 800 ton Lester machine, which is capable of making aluminium castings up to 25 lb. in weight. The weight of the untrimmed casting for the sewing machine body, i.e. weight of metal per shot, is 4¼ lb.

The crankshaft, a die-casting in Mazak III, is the chief functional member in the assembly (Fig. 4). Of ribbed section, it must be rigid but slender, and in this component, too, a major step forward was taken when pressure die-casting was first used. In the early model, when most of the parts were gravity castings, the crankshaft was in aluminium bronze. As such, a fair amount of machining was necessary, but as a pressure die-casting it is possible to cast-in the two small steel pins at the one end, core the pivot boss to size, and leave only a slight taper to be cleaned out of the slide for the drive pin. The remaining boss at the other extremity is drilled. In addition to a saving in machining, the die-cast part is approximately one-third the weight of the aluminium bronze casting, and a cost comparison of the two components shows the die-casting to be roughly one-third that of the gravity casting.

One further die-casting is used, the cover plate shown in Fig. 5. This is pressure die-cast in aluminium alloy,

Fig. 4—The crankshaft die-cast in zinc alloy

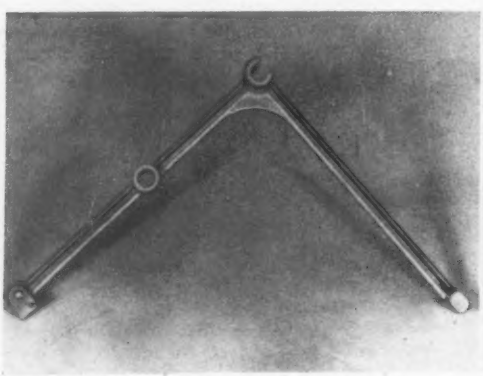
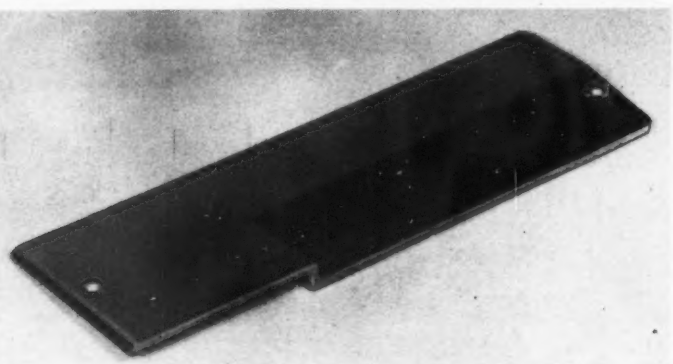


Fig. 5—Cover plate in aluminium alloy



and is a relatively simple plate, designed to blend into the body contours and give a pleasing appearance. It incorporates two holes with countersunk recesses cored in, and no machining at all is carried out on it.

One other feature of the economy in production—and this is an important factor in a machine that sells as a hand or electric model complete for under £10—is the finishing process. When gravity castings were used, it was necessary to undercoat and spray a hammer finish; with the pressure die-cast model, a satisfactory hammer finish has been achieved without the use of an undercoat, thus a complete painting operation has been eliminated.

Vacuum Die-Casting

THROUGH its affiliated Die Casting Research Foundation, the American Die Casting Institute has completed the development of a compatible, flexible vacuum method for use in the die-casting process. Disclosing this to our correspondent, Mr. David Laine, Secretary of the Institute, stated that applications for patents have been filed in the United States and most of the countries in Europe, including Great Britain.

During the period between the filing of the applications and the granting of patents, members of the Foundation are being licensed to use the vacuum systems forming part of the D.C.R.F. method, with a view to the systematizing of field experience of the method and the compilation of production data showing how these vacuum systems compare in productive efficiency with both non-vacuum and existing vacuum procedures.

Whilst no detailed description of the D.C.R.F. method is at present being made public, Mr. Laine stated that among its salient features are: (1) only the die cavity is evacuated; (2) vacuum is maintained throughout metal injection; (3) vacuum levels of 25-in. Hg, measured directly in the cavity, are consistently maintained without adverse effect on production time; (4) the method can conveniently be adapted to provide vacuum feeding to the shot-sleeve.

Power requirements are reported to be small, a 1 h.p. pump sufficing for the evacuation of two average die-casting machines, and little modification to existing dies is needed to adapt them to the system. Other sources state that, in fact, only about two hours work per die is needed for modification. Although the method avoids the use of complex valve controls, the problem of vent blocking that has in the past been the major shortcoming of vacuum systems has been overcome in the method developed by the Foundation.

Magnesium-Zirconium Alloys

MAGNESIUM alloys containing zirconium possess enhanced properties at room and elevated temperatures, and by their use the range of applications for which magnesium components are suitable has been greatly extended.

Such alloys are all based on the remarkable grain refining effect of zirconium on magnesium, first observed by F. Sauerwald in 1937. To achieve maximum grain refinement, it is necessary to saturate the magnesium with zirconium, for only the zirconium actually dissolved in the magnesium at the time of casting is effective in refining the grain and so in enhancing the tensile properties of the alloy.

Alloying with pure metallic zirconium does not give satisfactory results, and the commercial development of the magnesium-zirconium alloys has been based entirely on salt mixtures containing zirconium halides or semi-metallic "master alloys" made from them by reduction with magnesium as an intermediate step.

In their early work on the development of suitable salt mixtures for commercial use, Magnesium Elektron Limited explored salt mixtures containing $ZrCl_4$. When these were added to molten magnesium, the $ZrCl_4$ was reduced with formation of zirconium metal and simultaneous liberation of $MgCl_2$. Unfortunately, the latter became associated with precipitated zirconium-rich particles and gave rise to corrosive "flux" inclusions in the final alloy which, unlike previous ones, could not be removed by fluxing or remelting. Further, traces of residual moisture in the highly hygroscopic chloride were liable to introduce hydrogen into the melt with adverse effects on the alloy properties.

To eliminate these difficulties, M.E.L. devised a salt mixture based on the non-hygroscopic salt potassium fluozirconate. Unlike $MgCl_2$, the MgF_2 produced on reaction with magnesium, is non-hygroscopic and non-corrosive. With later modifications, this salt mixture became the well known Zirmel master salt. Experience has shown this alloying salt to give flux-free alloys with consistent high tensile properties, and since 1947 it has been used under licence by many foundries in Europe, Canada and the U.S.A.

The practical advantages of a metallic master alloy for introducing zirconium into magnesium—in particular, ease and simplicity of alloying with higher metal efficiency—were, however, always borne in mind, and as long ago as 1945, M.E.L. had developed and patented in the U.K. a master alloy made by reacting magnesium with a salt mixture containing zirconium chloride. However, the advantages of the fluoride approach were so marked that M.E.L. selected the fluoride-based master salt rather than the chloride-based master alloy for commercial development.

Meanwhile, persistent efforts had been made to prepare a master alloy based on the fluoride approach which would combine the practical convenience of master alloy with the high level performance of master salt.

The problem has recently been overcome and M.E.L. are now able to offer "Zirmax" hardener in place of "Zirmel" master salt. This hardener alloy contains about one third of its weight of alloyable zirconium and substantially the same total salt content as chloride-based master alloys; the balance is magnesium. The salt residue, however, is less hygroscopic and tends to be present in fewer, larger inclusions in the interior of the alloy. In consequence, Zirmax is more metallic in appearance than chloride master alloys and shows better keeping properties on storage. It is also more uniform, for the zirconium, virtually all of which is in suspension, shows little tendency to segregate either in crucible or mould.

Zirmax is supplied in notch bar suitable for the simple, direct alloying operation normally associated with the use of a hardener. One pound is equivalent in alloying power to over three pounds of master salt, and this is reflected in reduced sludge formation and in substantially higher metal recoveries—a major factor in the cost of the final product which assumes increased importance where expensive alloys, such as those containing thorium, are being processed.

The new hardener has proved remarkably uniform in its alloying properties, and all types of magnesium-zirconium alloy made with it show consistently the same high levels of tensile properties and the same freedom from residual chloride contamination as are obtained when master salt is used.

Analytical Reagent

FOR the determination of zinc by colorimetry, the reagent "Zincon" has been widely used, but a number of separations have frequently to be made because of interfering cations. In a booklet issued by Hopkin and Williams, Ltd., in their series "Organic Chemical Reagents," methods are described for determinations for zinc by absorptiometry and for mercury by absorptiometry and by volumetric determination. The booklet, No. 37 in the series, is obtainable from Hopkin and Williams, Ltd., Chadwell Heath, Essex.

METALLURGICAL FACTORS INVOLVED AT INDIVIDUAL STAGES OF PROCESSING

Production of Copper Sheet

By Dr.-Ing. OTTO NIELSEN

Current requirements for properties of copper sheet demand greater care in processing and this Paper, which has been specially translated for "Metal Industry," discusses those factors affecting sheet properties. It was presented originally before a meeting of the G.D.M.B. (Association of German Mining and Metallurgical Engineers)

GOOD appearance, corrosion resistance, ease of fabrication by pressing and spinning, properties so characteristic of copper sheet, have always been highly valued. So far as the appearance of the sheet is concerned, i.e. its surface finish, the demands have, however, been stepped up very considerably in recent years. This high surface finish is certainly necessary in the case of polished sheet, and sheet which is to be electroplated. In many other cases, however, this degree of surface finish is not really necessary.

Whereas formerly individual sheets in the course of fabrication into finished products or plant and the like were joined by riveting or soldering, joining to-day is effected almost exclusively by welding. In this connection, a new requirement is that the copper sheet should be readily weldable.

It is thus seen that to-day copper sheet has, on the one hand, to meet higher requirements in regard to quality while, on the other hand, there are also new hitherto non-existent demands.

Types and Quality of Slabs

The production of copper sheet starts with the casting of suitable cakes or slabs. These can be divided as follows, depending on shape and method of production:

(a) Cakes cast in open horizontal moulds.

(b) Cakes cast in individual vertical moulds.

(c) Slabs cast by the semi-continuous process and, finally, as the latest stage of development.

(d) Slabs cast by the continuous process.

The classification of the slabs or cakes is thus based on the casting process used for their production. One might deduce therefrom that a discussion of the various aspects of these processes would be restricted to the interests of those concerned with the casting of copper slabs. In what follows it will be shown that such a limitation does not apply. The methods of producing the rolling slabs and cakes, i.e. the foundry practice, leads to certain properties of the slabs, and these properties have to be taken into account in the course of subsequent processing of the slabs, in particular by the rolling mill operator. There exist, namely, interrelations between the type of slab, i.e. the method of casting used in its production, and the chemical and physical characteristics of the slab which determine the way in which it has to be treated. This fact is confirmed, according to the author's view, by the practice being adopted by German and other producers of copper slabs of issuing directives as to the factors that should be taken into consideration in processing the slabs supplied by them.

It is, therefore, of interest to consider the characteristic properties of slabs of the various types classified above.

Horizontally-cast copper cakes. The horizontally-cast copper rolling slab or cake was, until recently, practically the only type produced. The size of the cake varies between 100 and 6,000 kg.

As the term horizontally-cast cake implies, the main feature of this process of casting is that, in casting, the largest faces of the cake lie horizontally. It is these faces which, after rolling, become the surfaces of the sheet. These two faces are not equivalent, since the upper surface is not formed against a mould wall but solidifies freely in contact with the air. This fact creates corresponding conditions of crystallization during the solidification of the cake.

In casting the horizontally-cast cakes, the height through which the stream of molten metal from the pouring nozzle or ladle has to fall is very small. This has a favourable effect on the nature of the bottom face of the cake. The same is true of the side faces.

The formation of the upper face of the cake, which solidifies while exposed to the atmosphere, depends on a number of factors. It is desirable that, after solidification, the upper surface of the cake should be as level as possible. In view of the size of this surface, the maintenance of a definite degree of poling is even more important and even more difficult than when casting wirebars. If the oxygen content is too high, the surface of the cakes sinks in. If poling has resulted in the removal of too much oxygen, the surface will bulge upwards. The degree of poling and the oxygen content required to give a level surface depend on the size of the cake. Large cakes require, in general, a higher oxygen content than smaller cakes. The absolute values of the oxygen contents depend, however, on the sulphur content and on the contents of other gases of the molten copper. Low sulphur contents require lower oxygen contents. The differences are of the order of a few hundredths of one per cent. It will be seen, however, that, in view of the above, it is not possible to select any desired oxygen content. Thus, the production of oxygen-free cakes by the horizontal casting process is not possible.

Because the cake solidifies with its large upper face exposed to the air, the upper layer of metal in the cake will have a higher cuprous oxide content, in the same way as is found in the case of horizontally cast wirebars. The depth of layer with a higher oxygen content will depend on the pouring temperature and the conditions of cooling.

The effect of these peculiar solidification conditions (bottom and side faces in contact with mould walls, upper surface exposed to the air) on the crystal structure of the cakes was described in a paper by Siebe and Katterbach published in 1927. In spite of the length of time between the publication of this work and the present, these well-known facts are still quite often not sufficiently considered in practice. It was then shown that in a horizontally-cast cake, the interior has a fine-grained structure, whereas towards the outside, needle-shaped and columnar crystals predominate. Portions near the lower and upper faces exhibit different structures.

Observations regarding horizontally-cast cakes can, therefore, be summed up by saying that: (1) the cakes contain oxygen; (2) the upper surface layer has a higher oxygen content; (3) the grain structure comprises different zones, the structure of the lower and upper zones being different.

Vertically-cast cakes. In the case of the vertically-cast cakes one can distinguish between cakes with tapering sides, the so-called wedge cakes, and the cakes with parallel or substantially parallel sides, the so-called V.C. cakes. In the case of the wedge cake, the wedge shape is necessary to enable the solidified cake to drop out of the mould, which is usually solid and is in contact with the cake over five of its faces. The V.C. cake necessitates the use of moulds having carefully-finished surfaces. The bottom of the mould is formed by a special hinged portion. Water-cooling is employed to prevent the moulds from becoming distorted. The making of these moulds involves considerable machining and they are, therefore, very expensive. The vertically-cast cakes have the great advantage that their large faces, which also

go to form the surfaces of the sheet, solidify in contact with the mould walls. This, as will be seen, greatly simplifies rolling and cleaning operations.

The control of the poling in casting tough pitch copper, i.e. the control of the oxygen content of the metal, is, however, again difficult, especially if it is desired to avoid the cropping of the cake.

By using a suitable mould wash it is also possible to cast phosphor-deoxidized copper. This does, however, result in the formation of a shrink head, which has to be sawn off. Under special conditions it is likewise possible to cast O.F.H.C. copper in the form of vertical cakes.

As compared with horizontally-cast cakes, the crystallization and solidification conditions are better, so far as the production of sheet is concerned, in that the two large faces are equivalent. There are, it is true, differences between the head and the bottom of the cake, due, for one thing, to casting difficulties brought about by the relatively considerable height through which the stream of molten metal must fall at the commencement of the pour, and, for another, by the head of the cake containing a coarser grain and higher content of pores due to the fact that the metal in it remains molten for a longer time.

Semi-continuously Cast Slabs. The fact that slabs cast by the semi-continuous process have a length several times that of cakes cast in vertical moulds brings about a number of metallurgical advantages, quite apart from the elimination of the need for a large number of moulds. The stream of molten metal has to fall always through a constant height, with the result that the less satisfactory zones formed at the commencement of the casting process and those at the top of the slab, which are the last to solidify, constitute a relatively much smaller fraction of the slab. The crystallization conditions are otherwise practically constant over the whole remaining length of the slab. The two large faces of the slab are likewise equivalent and smooth.

Metal composition can be varied between wide limits. The production of slabs with higher oxygen contents, such as those met with in horizontally-cast cakes, does, however, cause difficulties. As, however, a higher oxygen content is not regarded as particularly advantageous or desirable, on the contrary, being accepted as more or less inevitable in the case of the other methods of casting, this does not present any real disadvantage. The phosphorus content can be varied within any desired limits.

The semi-continuous casting process certainly represents an important step forward from the point of view of the production of copper sheet.

Continuously Cast Slabs. The favourable factors referred to in connection with the preceding process are also encountered in the fully-continuous casting process. There is also an additional factor. The fact that—apart from occasional interruptions—the metal is poured continuously, reduces the structural differences at the beginning and the end of the slab to a minimum relative to the volume of metal cast.

Processing Cake to Sheet

After this general survey of the characteristics of the different types of cakes, there arises the question as to the conclusions it is possible to draw from it regarding the subsequent processing of the cakes.

First Treatment of Cakes in Further Processing. To begin with, some general remarks regarding porosity in the cakes may be made. It is known that the specific weight of cast material is lower than that of wrought metal produced by rolling, pressing or extrusion. This difference in specific gravity represents the pore content of the metal and thus indicates the presence of pores in the cast metal, or, more correctly, the presence of voids. What happens to these pores or voids in the course of subsequent working of the metal? In this connection a distinction must be made between the relatively few large pores and the numerous small pores, frequently called micropores.

Furthermore, it is to be noted whether the pores are completely enclosed by the metal or whether they are open to the "outside world." Pores lying in the interior of the metal have been observed by the author always to have a clean interior surface and can be regarded as being "relatively empty." (If these pores were filled only with non-diffusing gases, these would, at normal temperature, occupy one-fifth of the empty space, or, in other words, the pressure in the interior of the pores would amount to only one-fifth of that of the atmosphere). Other voids may be formed as a result of shrinkage. These are the so-called shrinkage cracks in which, provided they are not open to the atmosphere, there is, in the case of metal of low gas content, practically a vacuum.

If one considers that copper is readily weldable at elevated temperatures, it will be clear that these various voids and pores disappear when the metal is worked at suitable temperatures, leaving no ill-effects so far as the quality of the rolled metal is concerned. The correctness of this view is shown by the fact that sound, dense semi-manufactured metal can be produced even from metal powder.

The state of affairs is different when the pores or voids extend to the surface of the slab. In that case, the formation of oxide will have undesirable effects.

These considerations already indicate the factors of importance for further working of slabs. In this connection it is necessary to take note of:

(1) The porosity or density of the metal.

(2) The composition of the metal of the slab.

(3) The grain structure of the slab.

It must, of course, be the aim of the producers of cakes to obtain cast metal which is as dense and pore-free as possible. Developments in casting practice have resulted in a steady improvement in the density of the metal, and the specific gravity of the continuously-cast slabs indeed approaches very closely the possible maximum of 8·93. The achievement of a hundred per cent soundness, i.e. absolute freedom from porosity cannot, however, be expected.

It has already been pointed out that there is a difference between pores which are completely enclosed by the metal and those that are not. One should, therefore, try to avoid interior pores becoming "exterior" pores. Thus it is worth considering whether it is advisable to subject the cast cakes, as a first step, to a surface turning or milling operation, as the latter can result in harmless interior pores becoming harmful surface defects. The author adopts the standpoint that such machining of the slabs should be avoided. This is particularly so in the case of slabs of which surfaces that have solidified against mould walls ultimately go to form the surfaces of the sheet.

Where horizontally-cast cakes are concerned, one side of the cake will consist of the freely solidified face having a rough surface and enriched in oxygen. This means that, where high grade sheet is to be produced, a machining of this surface cannot be avoided. Difficulties can only be prevented if this surface is removed to a sufficient depth.

It is helpful, when using the sheet to fabricate various parts e.g. by spinning, if it is arranged that the surface of the sheet corresponding to the face of the cake which solidified against a mould face goes to form the outside surface of the part. Such a suggestion is not well received by the user of the sheet, as it would mean that the position of the particular surface would have to be checked at each stage of the manufacturing process. In any case, this consideration has lost its importance since the horizontally-cast cake now belongs almost wholly to the past.

With the other types of slab, the first step in processing should consist of the removal of the larger visible casting defects. Attention should first be given to the surface after hot rolling. This, where high quality sheet is being produced, will in any case be necessary for the purpose of removing the scale formed during hot rolling.

The general recommendation is, therefore, to hot roll the slab with all the surface dirt, etc., and then to mill the surface after hot rolling preferably using a Torrington slab miller.

Preheating Hot Rolling Slabs

For hot rolling, the slabs must be preheated to the hot rolling tempera-

ture, and in this connection the following questions need to be considered:

(a) In what kind of furnace atmosphere should the slabs be preheated?
(b) To what temperature?
(c) What should be the time of heating?

Furnace Atmosphere. There is no general rule as to what atmosphere in each particular case is the correct or wrong one, i.e. which is useful and which is harmful. It involves consideration of whether the slab contains oxygen or is free from oxygen and whether or not an excess of phosphorus is present.

In the case of oxygen-containing or tough pitch copper, it is necessary to avoid a reducing atmosphere at all stages of the preheating and annealing treatments, as such an atmosphere may cause hydrogen embrittlement of the metal. Formerly this possibility was taken less seriously in the case of preheating of slabs as compared with the annealing of sheet because superficial hydrogen embrittlement became masked by the subsequent hot rolling. More care is however indicated in this respect in the preheating of slabs with a view to reducing edge cracking.

Thus the following rule is obtained: on preheating oxygen-containing copper — whether containing much or little oxygen — a slightly oxidizing atmosphere should be used and not a reducing one.

Regarding O.F.H.C. copper, the directive given by the suppliers of the metal is to the effect that it should preferably be preheated in a reducing atmosphere, although a neutral atmosphere can also be used. In no circumstances should an oxidizing atmosphere be used. This directive applies also in the case of all other types of oxygen-free copper produced by other methods and not containing a reducing agent such as an excess of phosphorus. Why an oxidizing atmosphere should be avoided can be seen from the following consideration. When copper is heated in air, there occurs not only a surface scaling, but the oxygen also penetrates into the interior of the metal as a result of its slight solubility in copper. As a result of this, the chief advantage of the oxygen-free copper, namely its resistance to hydrogen embrittlement, is lost.

Copper containing an excess of phosphorus is the least sensitive to the composition of the furnace atmosphere: reducing atmospheres are unable to cause hydrogen embrittlement; oxidizing gases are removed by the excess of phosphorus. Since, however, it is generally desired to retain this excess of phosphorus in connection with any welding of the semi-manufactured products, it will, in general, still be necessary to preheat this type of copper under the same conditions as those for oxygen-free copper.

Preheating Temperature. The preheating temperature is taken to mean also the temperature at which the slabs reach the first rolling pass.

There existed, and unfortunately still to some extent exists, the practice of rolling at as low a temperature as possible. This is done with a view to reducing scale formation to a minimum. The scale causes loss of metal on the one hand, and on the other, the coarser particles of scale at the higher temperatures produce a rough surface.

Copper is, of course, ductile and can be worked at practically any temperature, and there are no transformation points. Nevertheless, "cold" hot rolling does result quite often in transverse cracks of various sizes which develop especially after the first few passes. These rolling cracks cannot be blamed on unsatisfactory metal, i.e. on the chemical composition of the copper, but are caused by the nature of the solidification grain structure.

Because of the equally oriented grains in the upper zone and of the irregularly oriented grains in the adjoining lower zone, these zones will offer a different resistance to deformation by rolling. Should the lower zone elongate more under the rolling pressure than the upper zone, the latter will develop cracks.

This difference in behaviour diminishes as the temperature is raised. and cracking is thereby prevented.

Typical rolling temperatures recommended by different suppliers of copper slabs include. for example. the following ranges: 800°-830°C.. 788°-816°C. and 760°-810°C. Within these ranges the actual temperature used is not critical.

A high rolling temperature is not only desirable with a view to avoiding cracking. but is also required to ensure the satisfactory welding up of the pores to which reference was made earlier.

Preheating Time. One recommendation as to the time for which the cakes are to be preheated is that the only condition to be observed in this respect is that the metal should be heated and brought to a uniform temperature throughout the whole of its bulk. The duration of the preheating is otherwise not critical. A directive given on the basis of experience by another supplier recommends that 350 kg cakes should be preheated for about 2 hr. General rules cannot be given. the preheating time depending ultimately on the size of the slabs and on the capacity of the furnaces.

Hot Rolling

Given a suitably preheated slab. i.e., a slab for which the furnace atmosphere. time of preheating and preheating temperature have been chosen correctly, there remains to consider the sequence of rolling passes to which it is to be subjected.

There exist a number of recommendations regarding this problem. Because of the different structure of the different types of slabs, it is advisable that an appreciable reduction should be given in the very first pass. The tendency to use too gentle a treatment in the first few passes is quite wrong. The maximum value of the first reduction is determined not by the grain structure of the slab, but solely by the capacity of the rolling mill and its drive. In general, reductions of 17 to 20 per cent in thickness have been recommended, while some authorities have even suggested reductions of 20 to 50 per cent.

In order to ensure that the first pass does, in fact, result in the application of a sufficiently high pressure, it is necessary to know the thickness of the cake in order to be able to set the roll gap to the required size. This may sound a platitudinous statement, but it must be remembered that horizontally-cast cakes do, in fact, vary in thickness. The thickness, likewise, varies in the case of the wedge cakes because of their shape. It sometimes happens that the exact thickness of horizontally-cast cakes is not measured before the first pass. Instead of actually measuring the thickness, the practice is often adopted of starting by opening the roll gap an adequate amount in order to avoid cracking, and then adjusting it to suit the cakes. Should a cake on the thin side pass through the rolls, it will, as a result, be given an inadequate reduction. In the case of wedge cakes, the rolls should be set to suit the minimum thickness of the cake.

It will be clear that in order to simplify the choice of the reduction in the first pass, slabs of uniform and constant thickness are desirable. This is obtained in the V.C. and continuously-cast slabs.

How far reduction is to be, or can be, carried in the first hot rolling process, i.e., the thickness of the stock at the end of the process, will depend on the rolling programme as a whole. It is also necessary to ensure that no unsatisfactory texture can develop.

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Lifting Magnets

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For the moment its manufacture is to be restricted to three sizes: 52 in., 62 in. and 72 in. This company's standard circular lifting magnets will continue to be manufactured in a wide range of sizes, i.e. 2 in. to 76 in., all possessing a built-in experience of well over fifty years' standing.

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ture, and in this connection the following questions need to be considered:

(a) In what kind of furnace atmosphere should the slabs be preheated?
(b) To what temperature?
(c) What should be the time of heating?

Furnace Atmosphere. There is no general rule as to what atmosphere in each particular case is the correct or wrong one, i.e. which is useful and which is harmful. It involves consideration of whether the slab contains oxygen or is free from oxygen and whether or not an excess of phosphorus is present.

In the case of oxygen-containing or tough pitch copper, it is necessary to avoid a reducing atmosphere at all stages of the preheating and annealing treatments, as such an atmosphere may cause hydrogen embrittlement of the metal. Formerly this possibility was taken less seriously in the case of preheating of slabs as compared with the annealing of sheet because superficial hydrogen embrittlement became masked by the subsequent hot rolling. More care is however indicated in this respect in the preheating of slabs with a view to reducing edge cracking.

Thus the following rule is obtained: on preheating oxygen-containing copper — whether containing much or little oxygen — a slightly oxidizing atmosphere should be used and not a reducing one.

Regarding O.F.H.C. copper, the directive given by the suppliers of the metal is to the effect that it should preferably be preheated in a reducing atmosphere, although a neutral atmosphere can also be used. In no circumstances should an oxidizing atmosphere be used. This directive applies also in the case of all other types of oxygen-free copper produced by other methods and not containing a reducing agent such as an excess of phosphorus. Why an oxidizing atmosphere should be avoided can be seen from the following consideration. When copper is heated in air, there occurs not only a surface scaling, but the oxygen also penetrates into the interior of the metal as a result of its slight solubility in copper. As a result of this, the chief advantage of the oxygen-free copper, namely its resistance to hydrogen embrittlement, is lost.

Copper containing an excess of phosphorus is the least sensitive to the composition of the furnace atmosphere: reducing atmospheres are unable to cause hydrogen embrittlement; oxidizing gases are removed by the excess of phosphorus. Since, however, it is generally desired to retain this excess of phosphorus in connection with any welding of the semi-manufactured products, it will, in general, still be necessary to preheat this type of copper under the same conditions as those for oxygen-free copper.

Preheating Temperature. The preheating temperature is taken to mean also the temperature at which the slabs reach the first rolling pass.

There existed, and unfortunately still to some extent exists, the practice of rolling at as low a temperature as possible. This is done with a view to reducing scale formation to a minimum. The scale causes loss of metal on the one hand, and on the other, the coarser particles of scale at the higher temperatures produce a rough surface.

Copper is, of course, ductile and can be worked at practically any temperature, and there are no transformation points. Nevertheless, "cold" hot rolling does result quite often in transverse cracks of various sizes which develop especially after the first few passes. These rolling cracks cannot be blamed on unsatisfactory metal, i.e. on the chemical composition of the copper, but are caused by the nature of the solidification grain structure.

Because of the equally oriented grains in the upper zone and of the irregularly oriented grains in the adjoining lower zone, these zones will offer a different resistance to deformation by rolling. Should the lower zone elongate more under the rolling pressure than the upper zone, the latter will develop cracks.

This difference in behaviour diminishes as the temperature is raised. and cracking is thereby prevented.

Typical rolling temperatures recommended by different suppliers of copper slabs include. for example. the following ranges: 800°-830°C.. 788°-816°C. and 760°-810°C. Within these ranges the actual temperature used is not critical.

A high rolling temperature is not only desirable with a view to avoiding cracking. but is also required to ensure the satisfactory welding up of the pores to which reference was made earlier.

Preheating Time. One recommendation as to the time for which the cakes are to be preheated is that the only condition to be observed in this respect is that the metal should be heated and brought to a uniform temperature throughout the whole of its bulk. The duration of the preheating is otherwise not critical. A directive given on the basis of experience by another supplier recommends that 350 kg cakes should be preheated for about 2 hr. General rules cannot be given. the preheating time depending ultimately on the size of the slabs and on the capacity of the furnaces.

Hot Rolling

Given a suitably preheated slab. i.e., a slab for which the furnace atmosphere. time of preheating and preheating temperature have been chosen correctly, there remains to consider the sequence of rolling passes to which it is to be subjected.

There exist a number of recommendations regarding this problem. Because of the different structure of the different types of slabs, it is advisable that an appreciable reduction should be given in the very first pass. The tendency to use too gentle a treatment in the first few passes is quite wrong. The maximum value of the first reduction is determined not by the grain structure of the slab, but solely by the capacity of the rolling mill and its drive. In general, reductions of 17 to 20 per cent in thickness have been recommended, while some authorities have even suggested reductions of 20 to 50 per cent.

In order to ensure that the first pass does, in fact, result in the application of a sufficiently high pressure, it is necessary to know the thickness of the cake in order to be able to set the roll gap to the required size. This may sound a platitudinous statement, but it must be remembered that horizontally-cast cakes do, in fact, vary in thickness. The thickness, likewise, varies in the case of the wedge cakes because of their shape. It sometimes happens that the exact thickness of horizontally-cast cakes is not measured before the first pass. Instead of actually measuring the thickness, the practice is often adopted of starting by opening the roll gap an adequate amount in order to avoid cracking, and then adjusting it to suit the cakes. Should a cake on the thin side pass through the rolls, it will, as a result, be given an inadequate reduction. In the case of wedge cakes, the rolls should be set to suit the minimum thickness of the cake.

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All-transistor circuitry enables the instrument to be operated for long periods from a battery supply.

The dual phosphor technique enables both alpha and beta contamination to be monitored simultaneously. Separate distinctive tones are provided for alpha and beta either on headphones worn by the operator, or a built-in loudspeaker. The new monitor is said to provide high accuracy over a wide temperature range (0°C. to 45°C.), and by using a single switch it is possible to monitor the sum of alpha and beta contamination, beta contamination alone, or just alpha contamination. This information, in the form of counts per second, is displayed on a meter covering the range 0-5,000.

The overall dimensions of the unit are 11½ in. by 8 in. by 8½ in., its weight approximately 11 lb., and power consumption ¼ watt.

Zinc Mine to Re-open

News from the U.S.A. is that the American Zinc, Lead and Smelting Company will re-open mining and milling facilities in New Diggins, Wisconsin, closed in 1957 because of a low price for slab zinc, according to Mr. Howard I. Young, president. Zinc now is priced at 12 cents a lb., as compared with ten cents a lb. when the Wisconsin mines were closed. The mines will be in full operation in four to six weeks, Mr. Young said. Production of zinc and lead concentrates, starting with 1960, is expected to be at an annual rate of 12,000 to 15,000 tons, he added.

Aluminium Curtain Walling

An exhibition now being held at the Building Centre, Store Street, London, W.C.1, displays the most comprehensive array of curtain walling systems yet staged anywhere in the world. It consists of 30 uniform panels carrying full-sized sections of each of the 15 British walling systems represented and displaying section drawings, brief factual statements, and photographs of existing installations in which the systems have been applied.

The existence of at least 15 major curtain walling systems in this country is evidence by itself of the way in which this method of construction has caught on. The exhibit shows examples of aluminium left in its natural state, anodized in the normal silver finish, and anodized and dyed in one of a range of attractive colours. Specifications exist in respect of weather resistance and colour fastness.

The exhibition is to remain open until October 24. It is accompanied by an explanatory leaflet in which each system is fully described and illustrated. Recent films, depicting modern architectural trends in Europe and America, are also to be seen.

Australian Tariff Board

It is learned from the Board of Trade that the Australian Minister of Trade has referred to the Tariff Board for inquiry and report the question of whether assistance should be accorded the production of unwrought copper.

United Kingdom trade associations or firms intending to submit evidence to the Tariff Board should so advise the Board of Trade, Commercial Relations and Exports Department, by October 23 next, quoting reference number C.R.E. 10166/59.

Autumn Meeting

It is announced that the Autumn Meeting of the **Institute of Welding** will be a joint one with the French Society of Welding Engineers. The meeting will be held in London from November 3 to 6 next and will open with a reception at the Institute on the evening of Tuesday, November 3, following the Presidential Address by Mr. E. Seymour-Semper, M.I.Mech.E.

The programme will also include the annual dinner of the institute at the Park Lane Hotel, London, on the evening of November 4. In addition to the technical sessions to be held, a number of visits to laboratories and works have been arranged for the French guests.

Welding Courses

During next month two more courses are to be held at the **School of Welding Technology.** The first course will be held from November 9 to 13 and the subject will be "Welded Design and Construction in Aluminium Alloys".

The second course will be held from November 23 to 27 and will deal with "Welding in Shipbuilding". Full particulars of these and other courses may be obtained from the Institute of Welding, 54 Princes Gate, Exhibition Road, London, S.W.7.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell by 256 tons, to 8,338 tons, comprising London 4,724, Liverpool 3,454 and Hull 160 tons.

Copper stocks fell by 175 tons to 13,063 tons and were distributed as follows: London 3,097, Liverpool 6,591, Birmingham 375, Manchester 3,000 tons.

Copper Stockpile

It has been reported that the United Kingdom copper stockpile is now almost cleared. There were 30,000 tons for disposal at the end of 1958, and since then three calls for tenders have been made. A Board of Trade spokesman is said to have told Comtel that very little is now left in the stockpile and this will be sold as opportunity offers. At the same time, it was pointed out that some copper still remains to be delivered against tenders already accepted.

Flooding a Mine

Recent news from La Paz is that the Bolivian Mining Corporation, which manages Bolivia's nationalized mines, has announced that the Pulacayo lead-zinc-silver mine is to be flooded after 126 years of continuous exploitation.

The mine's reserves, once an important source of revenue, have now run out. The mine, which has been inactive since June last, employed 1,000. All equipment will be removed before the flooding takes place. Previous owners were the Hochschild Group and the French Huanchaca Company.

European Free Trade

The Stockholm Draft Plan for a European Free Trade Association of the United Kingdom, Austria, Denmark, Norway, Portugal, Sweden and Switzerland, proposed that the base date for determining the tariff rates to be progressively reduced in accordance with the plan should be January 1, 1960. The plan also proposed that the tariff rates so determined should be those actually applied on that date but recognized that, in certain circumstances, departures from this general rule should be allowed.

Certain goods will, on January 1, 1960, be temporarily exempt from duty on importation into the United Kingdom. The goods so exempt may be ascertained by reference to the Import Duties (Temporary Exemptions) (No. 9) Order, 1959, and to the earlier Orders listed in the Second Schedule to that Order.

The Board of Trade invite all interested parties who wish to have further information about the reimposition on imports from the member countries of the European Free Trade Association after January 1, 1960, of duties temporarily suspended on that date to write to Tariff Division, Board of Trade, Horse Guards Avenue, London, S.W.1, by October 23, 1959. Such requests for information should, as far as possible, be related to specific goods as described in the Import Duties (Temporary Exemptions) Order referred to above.

Nickel Bulletin

Cereal rusts occur annually in most of the grain-growing areas of the world, and in some years the disease reaches epidemic proportions, attacking, to a varying degree, millions of acres of crops. Research on the development of fungicides capable of preventing or eliminating the disease has been in progress for some time, and recent findings by workers in this field indicate that nickel compounds offer some promise of a solution to the problem. Abstracts of five papers reporting these findings form an interesting feature of the August issue of *The Nickel Bulletin.* Other abstracts in the same section are concerned with extraction and refining of nickel, the properties and determination of the metal, and its use in aircraft batteries.

The remainder of the seventy or so abstracts reflect, in their diversity, the wide range of industries and applications in which nickel plays a major part. In the electrodeposition section attention is drawn to papers on the corrosion-resistance of duplex nickel coatings and to a comprehensive investigation of the production and properties of coatings deposited by thermal decomposition of nickel carbonyl. Reference is made to a paper describing the use of nickel-iron films in digital computers and, in the section on cast iron, to inoculation of castings by vibration during solidification. The eleven papers abstracted in the section concerned with nickel-containing constructional steels cover testing, fabrication, properties, susceptibility to embrittlement and applications in the automobile industry.

The literature on nickel-containing heat- and corrosion-resisting materials ranges in its subject matter from precipitation reactions during ageing and the influence of hot working on creep properties, to fabrication, gas lubrication, and resistance to intergranular and pitting corrosion.

Engineering Exhibition

At the forthcoming Engineering Industries Association Twelfth Engineering Display, which will be held in the Royal Horticultural Society Hall, at Westminster, on October 20 to 22, an interesting exhibit will be provided by **Electrical Remote Control Company Ltd.**

Among the range of products to be shown will be a number of fully-automatic multiple circuit multiple interval timers for operation from A.C. and D.C. supplies; a range of hand reset and semi-automatic single interval and multiple interval multiple circuit timers for operation from A.C. and D.C. supplies; a range of multiple contact and mercury relays

for operation on A.C. and D.C. supplies, and also a range of low voltage soldering irons.

A 1960 Event

Advance notice is given of the Conversazione which is being arranged by the Corrosion Group of the **Society of Chemical Industry** at the Battersea College of Technology during the evening of Thursday, January 21, 1960. Exhibits are invited for the usual exhibition which accompanies the Conversazione and which will illustrate the progress of research and development in any aspect of metallic corrosion and its prevention.

Industrial Safety

Brighton is the venue this year of the annual conference of the **Institution of Industrial Safety Officers,** which is being held at the Grand Hotel on Friday, November 6, and continues until lunchtime on the following Sunday, November 8.

The conference will open with a dinner at 7 p.m., at which the speakers will be Mr. R. A. Banks, director of Imperial Chemical Industries Limited, Brigadier R. F. E. Stoney, and the retiring President of the institution, Mr. R. E. Tugman.

The working sessions of the conference will be based on the theme "Education and Training Techniques for Safety", and during the opening session the framework of a safety course for supervisors will be discussed by representatives from different types of industry. Full details of the conference may be obtained from the offices of the Institution at Terminal House, 52 Grosvenor Gardens, London, S.W.1.

Theft of Metal

It has been reported to the National Association of Non-Ferrous Scrap Metal Merchants that the following was stolen between late Sunday night last and early the following morning, from the Harlow works of Entores Ltd:—80 sealed steel bottles of mercury, marked 11771/ Chiasso, or numbered 1403 to 1502. Anyone able to give any assistance as regards this theft is asked to communicate with Entores Ltd., at City Wall House, 14-24 Finsbury Street, London, E.C.2 (Telephone Monarch 6050).

Electric Winders for Australia

One of Australia's largest producers of lead, silver and zinc ores, North Broken Hill Mine, New South Wales, is in the process of commissioning a new shaft equipped with winders supplied by **Associated Electrical Industries Limited.** When the shaft is finished, the winders will be raising men and minerals from a depth of nearly a mile.

All the electrical equipment for these winders was supplied by the Manchester factory of A.E.I. heavy plant division.

Swedish-Dutch Metal Trading

It has been reported from Rotterdam that Swedish and Dutch metal industries have announced intentions for closer co-operation. "Both countries have been worried by recent European developments such as the Common Market and the Outer Seven group", the statement issued by the Swedish Mekanfoorbund and the Dutch Vereeniging Nederlandse Metaal Industrien said. Both groups said there should be "one large free European market". Details of the planned co-operation were not disclosed.

Sweden is a member of the Outer Seven Free Trade Area, while the Netherlands belongs to the Common Market Group. Present plans did not exclude metal industries in other countries, the statement said, and it was hoped to attract more industries from smaller nations.

Change of Address

A member of the Amber Group of companies, **Chas. H. Windschuegl Ltd.,** have left their Leadenhall Street offices in London and are now established in offices at the group headquarters, 11a Albemarle Street, London, W.1, where they will be able to make use of all facilities available to members of the group.

A Social Occasion

Grosvenor House, Park Lane, London, is to be the venue of the eighth annual dinner, dance and cabaret of the **British Bronze and Brass Ingot Manufacturers' Association.** This function will be held on Saturday, November 7 next, and tickets, price £3 10s. 0d., may be obtained from the secretaries to the Association—Heathcote and Coleman, 69 Harborne Road, Edgbaston, Birmingham, 15.

Forthcoming Meetings

October 13—Institute of Metals. South Wales Local Section. University College, Singleton Park, Swansea. "Metallurgical Applications of the Electron Microscope." J. Nutting. 6.30 p.m.

October 14 — Manchester Metallurgical Society. The Central Library, Manchester. Presidential Address. E. F. Emley.

October 14—Institute of Metal Finishing. Organic Finishing Group. London Branch. British Institute of Management, 80 Fetter Lane, London, E.C.4. "Some Notes on American Organic Finishing Practice." W. Stein and A. A. B. Harvey. 6.30 p.m.

October 14 — Society of Chemical Industry. Corrosion Group. 14 Belgrave Square, London, S.W.1. "Fretting Corrosion." K. H. R. Wright. 6 p.m.

October 15—East Midlands Metallurgical Society. School of Art, Green Lane, Derby. Presidential Address. H. E. Gresham. 7.30 p.m.

October 15 — Institution of Plant Engineers. Glasgow Branch. Scottish Building Centre, 425-427 Sauchiehall Street, Glasgow. "The Engineer's Approach to Non-Destructive Testing of Metals." H. Potter. 7.15 p.m.

October 15—Institution of Mining and Metallurgy. Rooms of the Geological Society, Burlington House, Piccadilly, W.1. General Meeting. 4.30 p.m.

October 15 — Birmingham Metallurgical Society and Birmingham Local Section of the Institute of Metals College of Technology, Gosta Green, Birmingham, 4. "Some Recent Developments in Coating and Processing of Steel Strip and Sheet." W. N. Jenkins. 6.30 p.m.

October 14—The Society for Analytical Chemistry. Midlands Section. Technical College, The Butts, Coventry. "The Analytical Chemistry of Tantalum and Niobium". A. R. Powell. 7 p.m.

Men and Metals

After 42 years with the Birmid group of companies, **Mr. William N. Sherlock** retired last week as director and secretary of Birmid Industries. Mr. Sherlock joined the Midland Motor Cylinder Company as secretary in 1917, and became secretary to the associate company, Birmingham Aluminium Casting (1903) Company in 1924. On the formation of Birmid Industries in 1936 he became secretary to that company, and by that time was secretary of six of the component companies. He was appointed to the boards of several companies in the group, and in 1943 became a director of Birmid Industries.

It has been announced by British Furnaces Limited that **Mr. F. Bonsall** has been appointed deputy managing director. He has been director and general manager of the company for the past four years.

At the annual general meeting of the British Standards Institution, held in London last week, **Mr. R. E. Huffam** was re-elected for a second term of office as President of the Institution. He also holds office as chairman of the General Council of the Institution. The three deputy-presidents of the Institution were also re-elected as follows:—**Sir Roger Duncalfe, Sir Herbert Manzoni** and **Mr. John Ryan.**

With 52 years' service to his credit, **Mr. Charles Fox,** partner in Daniel C. Griffith and Company, assayers to the Bank of England, has retired from the firm. **Mr. Alastair R. Griffith,** a great-grandson of the founder, has joined the directorate. The business will be carried on as before with the same technical staff.

It is learned from A. Strauss and Company Limited that **Mr. Walter Meier** has been elected to the board of directors of the company. Mr. Meier has served the company for many years as manager.

News from the George Cohen 600 Group is that **Mr. E. P. Purcell,** B.A.I., A.M.I.C.E., has been appointed to the board of directors of George Cohen (Dublin) Limited.

To succeed **Mr. A. Calley,** who has taken up a senior appointment with the Siemens Edison Swan Group, the London Electric Wire Company and Smiths Limited have appointed **Mr. C. G. Hill** to the position of London branch manager. Mr. Hill has been with the company for some 34 years, 22 of which were spent at their Leyton works.

Works director at Cowley, and chairman of the Motor Car Body Divisional Board, **Mr. Robert N. Davies** has been appointed a local director of the Pressed Steel Company. Mr. Davies joined the organization in 1926, became a superintendent in the early 1930s, was appointed to works management in 1952, and to the chairmanship of the Motor Body Divisional Board in 1957.

Metal Market News

LAST week saw an upward trend in values on the Metal Exchange, copper being particularly firm on the strike news. Aluminium, too, seemed to share in this bullish atmosphere, for there is talk of the official price being raised in the near future. The supply position in this metal does not seem to be quite as comfortable as it was, and there is uncertainty about imports from Russia from this month onwards. Both Wall Street and the London Stock Exchange provided a somewhat uncertain background, although sentiment improved at both centres towards the end of the week. Pending the outcome of the Election, the result of which should be known by the time this report is published, there is an element of uncertainty in the situation, which makes for caution in the conduct of business. By common consent, copper occupied the centre of the stage last week. Stocks in Metal Exchange Official Warehouses were reported up by 425 tons to 13,238 tons, a development which helped to maintain the contango, standing at 10s. when business came to an end on the previous Friday. On Tuesday, there was talk of trouble in the Congo, but since there was no suggestion that the copper mines were in any way involved, the market here was hardly affected. What proved to be of much greater moment were the developments at El Teniente, the Braden Company's mine in Chile. Wage negotiations with the mine workers had been going on for some time and a peace move appeared to be under way, but the company's proposition was, apparently, unacceptable to the "white collar" section of the employees.

It remained for the second half of the week to produce the most dramatic developments. For weeks past, October 1 had been anxiously awaited as the deadline for a possible walk-out by the Longshoremen's Union. In mid-week it seemed as though the worst might be avoided through the medium of a breathing space of a fortnight's duration, but in the event, men at one of the Gulf ports struck, and within a matter of hours shipping was paralysed all along the eastern seaboard of the United States. This was bad enough, but on Friday morning came the news that a strike had begun at El Teniente. In line with expectations, the midday market was strong, cash advancing by £5 5s. 0d. to £235, while three months put on £4, to close at £234 5s. 0d. This emphasis on the prompt position was natural enough in the circumstances, and a backwardation of 15s. did not seem excessive. In the afternoon, however, under selling pressure from an influential quarter, the quotation gave way, to close at £234 10s. 0d. cash, and £233 10s. 0d. three months. The Kerb was weak and business was done at about £1 lower. For the week, the turnover in the ring totalled about 10,200 tons, while probably another 1,000 tons changed hands in Kerb trading. On the week, cash gained £5 5s. 0d., but three months only £3 15s. 0d.

The outlook is now extremely uncertain, but higher prices seem likely to be seen, for the Braden strike has come at a time when supplies of copper outside the United States have been denuded by several thousands of tons as a result of shipment to the States. Moreover, the outlook for a settlement of the American steel strike seems pretty black, and as we write there is no indication of any peace move in the copper strike, which must by now have accounted for a loss of more than 100 000 tons of metal. As to the other metals, tin closed £1 up for cash at £794 10s. 0d., and £2 better in the three months position at £795. In lead, some 5,500 tons changed hands, the close at £70 5s. 0d. for October and £71 5s. 0d. for January showing little alteration on a week earlier. In zinc, a turnover of 5,275 tons brought a rise of 25s. in October to £87 5s. 0d., and of 12s. 6d. in January to £85 12s. 6d.

Birmingham

The revival which has taken place in the industrial Midlands is confirmed by the latest figures of unemployment which show that during the month just ended unemployment dropped by nearly 6,000, the biggest decrease in all the regions. In Birmingham alone, the total is fewer by 4,000 than a year ago and vacancies have increased by 3,000 to nearly 10,000. The oxygen strike has caused widespread stoppages in the motor trade and in the scrap metal industry. The Election has also been an adverse factor of the past week, but it is hoped that things will swiftly return to normal. Manufacturers generally have plenty of work on their books for the rest of the year.

Good progress is being made in the iron and steel trade. Improvement has been notable in all except the heavy steel department, but this is now showing definite signs of revival. Demand for steel sheets is maintained at a high level and there is a big market for iron castings for the engineering industries. More shifts are being worked in the re-rolling mills to meet the demand for small bars and sections. Bigger tonnages of semi-finished steel are being consumed. The demand for heavy plates is steady.

New York

On the Commodity Exchange, during the week-end, copper futures made fairly good advances during early dealings, but lost the gain later. Physical copper was described as moderately active. Dealers covering their requirements, it was reported by usually reliable sources, were willing to pay as much as 35·50 cents for copper in warehouses. The dock strike, trade observers point out, as far as copper is concerned, could become severe more quickly than for lead, zinc or tin due to labour difficulties within the industry, which have closed about 75 per cent of the U.S. copper-producing capacity since early August.

Lead and zinc were quiet. Tin prices were higher, but activity left much to be desired. Reliable trade sources say that existing large stocks of tin in the U.S. indicate that the dock strike would have to be of a long duration before it would affect supplies seriously. Towards the close, scrap copper went up by half a cent a lb. to 24·75 cents. Business at this level was small.

The Office of Civil and Defense Mobilisation has turned down an industry petition seeking higher tariffs and the placing of quotas on United States imports of cobalt. An announcement by Mr. Leo A. Hoegh, director of O.C.D.M., said that an investigation determined that cobalt imports were not threatening to impair the national security. The plea for relief against imports was requested by the Home Sound Company, of New York City, and its subsidiary, the Calera Mining Company. The principal supplier of cobalt to the U.S. market is the Belgian Congo. In 1958, U.S. imports of cobalt metal totalled 14,500,000 lb., of which 9,000,000 lb. came from the Belgian Congo, 2,000,000 from Belgium and 1,000,000 lb. from Canada.

Australia

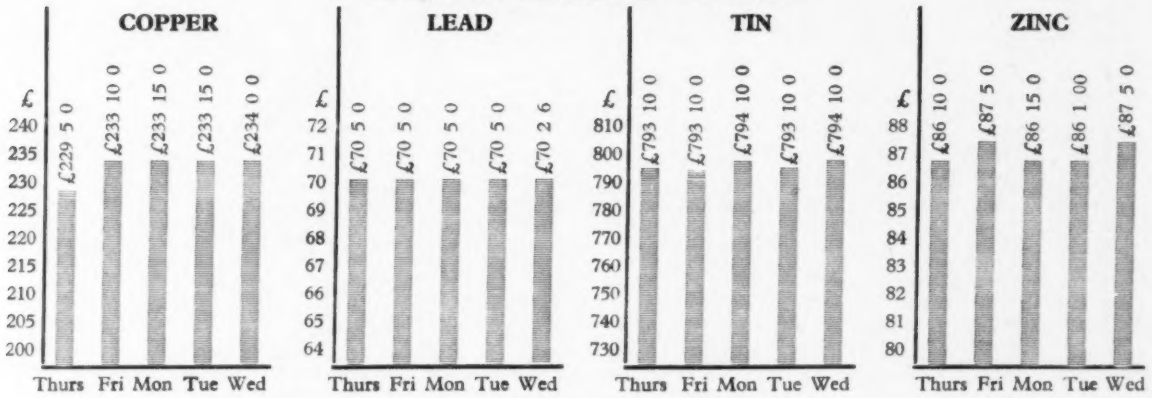
It is reported from Brisbane that Mount Lyell Mining and Railway has announced it will increase copper output this year. The chairman, Mr. W. E. Bassett, says in his annual review that the target for the current year is 11,000 tons of copper concentrate—the highest for many years. The mill will treat about the same tonnage of ore as in 1958-59, but grade will be slightly higher, he says. Ore reserves are now estimated at 38,233,000 tons, averaging 0·71 per cent copper, 0·067 oz. silver and 0·008 oz. gold a ton. Drilling within the company's mining leases during the past year gave "somewhat disappointing" results, but further downward extensions of the West Lyell ore bodies were proved. Drilling has already proved ore 1,500 feet below the final bottom of the open cut as at present planned.

The ore production rate of Mount Isa Mines, Limited, of Queensland, has increased 35 per cent in the last year, Mr. G. Fisher, chairman of Mount Isa Mines, Limited, has announced. He said the company spent more than £A20 million in the last three years on its expansion programme which was on schedule and would continue unchanged.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 1 October to Wednesday 7 October 1959



Primary Metals

All prices quoted are those available at 2 p.m. 7/10/59

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		9	0
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		14	0
Columbite	per unit		—	
Copper H.C. Electro	ton	234	0	0
Fire Refined 99·70%	„	233	0	0
Fire Refined 99·50%	„	232	0	0

		£	s.	d.
Copper Sulphate	ton	74	10	0
Germanium	grm.		—	
Gold	oz.	12	10	6¾
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	70	2	6
Magnesium Ingots	lb.		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	1
Alloy Ingot, A8 or AZ91	„		2	4
Manganese Metal	ton	245	0	0
Mercury	flask	71	10	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	

		£	s.	d.
Palladium	oz.	7	5	0
Platinum	„	28	10	0
Rhodium	„	41	0	0
Ruthenium	„	18	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	7⅛
Tellurium	lb.		15	0
Tin	ton	794	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	86	5	0
Dust 95/97%	„	114	0	0
Dust 98/99%	„	120	0	0
Granulated 99+%	„	111	5	0
Granulated 99·99+%	„	127	2	6

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏ £/ton		Canada c/lb ≏ £/ton		France fr/kg ≏ £/ton		Italy lire/kg ≏ £/ton		Switzerland fr/kg ≏ £/ton		United States c/lb ≏ £/ton	
Aluminium			22.50	185 17 6	224	168 0	375	221 5	2.50	212 10	26.80	214 10
Antimony 99.0					230	171 10	445	262 10			29.00	232 0
Cadmium					1.300	975 0					120.00	960 0
Copper												
Crude							455	268 10				
Wire bars 99.9												
Electrolytic	31.50	231 17 6	29.00	238 12 6	315	236 5 6			2.65	225 5	30.00	240 0
Lead			10.75	88 12 6	101	75 15	161	94 17 6	.87	73 17 6	13.00	104 0
Magnesium												
Nickel			70.00	578 5	900	675 0	1,200	708 0	7.50	637 10	74.00	592 0
Tin	111.00	817 2 6			1,124	843 0	1,500	885 0	9.70	824 12 6	103.25	826 0
Zinc												
Prime western			11.75	97 0 0								
High grade 99.95			12.35	102 0 0								
High grade 99.99			12.75	105 2 6								
Thermic					126.00	94 12 6						
Electrolytic					134.00	99 12 6	192	113 5	1.05	89 2 6	13.50	108 0

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 7/10/59

	£	s.	d.
Aluminium Alloy (Virgin)			
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10.... „	221	0	0
B.S. 1490 L.M.11.... „	215	0	0
B.S. 1490 L.M.12.... „	223	0	0
B.S. 1490 L.M.13.... „	216	0	0
B.S. 1490 L.M.14.... „	224	0	0
B.S. 1490 L.M.15.... „	210	0	0
B.S. 1490 L.M.16.... „	206	0	0
B.S. 1490 L.M.18.... „	203	0	0
B.S. 1490 L.M.22.... „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 .... ton	152	0	0
B.S. 1490 L.M.2 .... „	162	0	0
B.S. 1490 L.M.4 .... „	178	0	0
B.S. 1490 L.M.6 .... „	188	0	0
***Aluminium Bronze**			
BSS 1400 AB.1..... ton	240	0	0
BSS 1400 AB.2..... „	250	0	0

	£	s.	d.
***Brass**			
BSS 1400-B3 65/35 .. ton	154	0	0
BSS 249..... „		—	
BSS 1400-B6 85/15 .. „	202	0	0
***Gunmetal**			
R.C.H. 3/4% ton .... „		—	
(85/5/5/5) LG2 ..... „	193	0	0
(86/7/5/2) LG3 ..... „	203	0	0
(88/10/2/1)..... „	242	0	0
(88/10/2/½) ..... „	253	0	0
***Manganese Bronze**			
BSS 1400 HTB1 .... „	187	0	0
BSS 1400 HTB2 .... „	203	0	0
BSS 1400 HTB3 .... „	217	0	0
Nickel Silver			
Casting Quality 12% „	230	0	0
„ „ 16% „	237	0	0
„ „ 18% „	255	0	0
***Phosphor Bronze**			
B.S. 1400 P.B.1. (A.I.D. released)..... „	290	0	0
B.S. 1400 L.P.B.1.... „	213	0	0

** Average prices for the last week-end.*

	£	s.	d.
Phosphor Copper			
10% ..... ton	251	0	0
15% ..... „	253	0	0
Phosphor Tin			
5% ..... „		—	
Silicon Bronze			
BSS 1400-SB1 ..... „	245	0	0
Solder, soft, BSS 219			
Grade C Tinmans.... „	368	10	0
Grade D Plumbers .. „	296	5	0
Grade M ..... „	404	15	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „ „		—	
Zinc Alloys			
B.S.S.1004 Alloy A .. ton	120	7	6
B.S.S.1004 Alloy B .. „	124	7	6
Sodium-Zinc ..... lb.		2	7½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			
Sheet 10 S.W.G. lb.		2	8½
Sheet 18 S.W.G. „		2	10½
Sheet 24 S.W.G. „		3	1½
Strip 10 S.W.G. „		2	8½
Strip 18 S.W.G. „		2	9½
Strip 24 S.W.G. „		2	11
Circles 22 S.W.G. „		3	2½
Circles 18 S.W.G. „		3	1½
Circles 12 S.W.G. „		3	0½
Plate as rolled ..... „		2	8
Sections ..... „		3	2
Wire 10 S.W.G. .... „		2	11½
Tubes 1 in. o.d. 16 S.W.G. ..... „		4	1
Aluminium Alloys			
BS1470. HS10W.			
Sheet 10 S.W.G. „		3	1
Sheet 18 S.W.G. „		3	3½
Sheet 24 S.W.G. „		3	11
Strip 10 S.W.G. „		3	1
Strip 18 S.W.G. „		3	2½
Strip 24 S.W.G. „		3	10½
BS1477. HP30M.			
Plate as rolled .... „		2	11
BS1470. HC15WP.			
Sheet 10 S.W.G. „		3	9½
Sheet 18 S.W.G. „		4	2
Sheet 24 S.W.G. „		5	0½
Strip 10 S.W.G. „		3	10½
Strip 18 S.W.G. „		4	2
Strip 24 S.W.G. „		4	9½
BS1477. HPC15WP.			
Plate heat treated.. „		6	3½
BS1475. HG10W.			
Wire 10 S.W.G. „		3	10½
BS1471. HT10WP.			
Tubes 1 in. o.d. 16 S.W.G. ..... „		5	0½
BS1476. HE10WP.			
Sections ..... „		3	1½
Brass			
Tubes ..... „		1	10½
Brazed Tubes..... „		3	0½
Drawn Strip Sections „		3	0½
Sheet ..... ton	202	15	0
Strip ..... „	202	15	0
Extruded Bar..... lb.		2	0½
Extruded Bar (Pure Metal Basis) ..... „		—	

Brass			
Condenser Plate (Yellow Metal) ..... ton	194	0	0
Condenser Plate (Naval Brass) ..... „	205	0	0
Wire ..... lb.		2	8½
Beryllium Copper			
Strip ..... „	1	4	11
Rod ..... „	1	1	6
Wire ..... „	1	4	9
Copper			
Tubes ..... lb.		2	3½
Sheet ..... ton	264	15	0
Strip ..... „	264	15	0
Plain Plates ..... „		—	
Locomotive Rods .... „		—	
H.C. Wire ..... „	285	15	0
Cupro Nickel			
Tubes 70/30 ..... lb.		3	6½

Lead			
Pipes (London) .... ton	111	5	0
Sheet (London) .... „	109	0	0
Tellurium Lead .... „	£6 extra		
Nickel Silver			
Sheet and Strip 7% .. lb.		3	7½
Wire 10% ..... „		4	2½
Phosphor Bronze			
Wire ..... „		4	1
Titanium (1,000 lb. lots)			
Billet 4½" to 18" dia... lb.	54/-		55/-
Rod ¼" to 4" dia. .... „	95/-		62/-
Wire ·036"-·232" dia. „	167/-		110/-
Strip ·003" to ·048" .. „	200/-		75/-
Sheet 8′×2′. 20 gauge „	85/-		
Tube, representative average gauge .... „	300/-		
Extrusions ..... „	105/-		
Zinc			
Sheet ..... ton	122	0	0
Strip ..... „	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 6/10/59.

	£
Aluminium	
New Cuttings	149
Old Rolled	131
Segregated Turnings	104
Brass	
Cuttings	162
Rod Ends	151
Heavy Yellow	125
Light	119
Rolled	154
Collected Scrap	118
Turnings	143
Copper	
Wire	213
Firebox, cut up	205
Heavy	200
Light	193
Cuttings	215
Turnings	195
Braziery	162

	£
Gunmetal	
Gear Wheels	174
Admiralty.....	174
Commercial	160
Turnings	155
Lead	
Scrap	60
Nickel	
Cuttings	—
Anodes	550
Phosphor Bronze	
Scrap	160
Turnings	155
Zinc	
Remelted	76
Cuttings	63
Old Zinc	41

Financial News

New Company

On September 30 last, British Insulated Callender's Cables Limited signed an agreement with the Burndy Corporation of Norwalk, Connecticut, U.S.A., to form a new company in the United Kingdom to be known as Bicc-Burndy Limited, with an authorized capital of £250,000. The object of the company is to manufacture and market the existing range of Burndy products in this country and other parts of the Commonwealth. The new company will be in a position to supply all types of electrical connectors for Electricity Board transmission, distribution and power station work, for manufacturers of switchgear and appliances, and they will also provide connectors which have a wide application in the aircraft and shipbuilding industries.

Redro Group

It has been reported that Manganese Bronze and Brass Company has acquired all the issued share capital of Redro, other than its Redeemable Preference shares. Redro and its subsidiaries, Deans and Son (Yorkshire) and Beverley Fibre Glass, own an entirely self-contained light engineering concern.

E. Chalmers and Co.

Final dividend 10 per cent, making 15 per cent for year to August 31, 1959 (12½ per cent). Consolidated profit £48,884 (£34,081), before tax £24,000 (£17,150). Ordinary dividend takes £20,507 (£16,042). Forward £70,925 (£66,139).

A New Company

Formed with a capital of £100 in £1 shares, the Kaiser Aluminium Company Ltd. will carry on the interests in this country of the United States Kaiser Aluminium concern. So far, the U.S. company has limited its interests in Great Britain to supplying aluminium ingots. No indication has so far been given that this new venture portends a widening of these interests.

Amalgamated Tin Mines

Accounts of the Amalgamated Tin Mines of Nigeria for the year ended March 31 last show profit £182,774 (£223,353). Add provision against investment in subsidiary no longer required £24,188 (nil). Dividends (gross) from subsidiaries nil (£240,653), making £206,962 (£464,006). To tax—less adjustment for previous years of £9,000 (nil)—£56,500 (£217,500), contingencies reserve nil (£80,000), balance £150,462 (£166,506). Dividend £162,825 (£156,975), forward £285,538 (£297,901). Final dividend of 8 per cent, making 14 per cent for the year.

U.S. Copper Supplies

At the time of writing, American Metal Climax Incorporated reports that it no longer has any copper available for immediate or prompt delivery at 33 cents a lb. The big custom smelter, the only major custom plant still operating, is quoting 33 cents a lb. for December-January shipment orders. Foreign copper which it has available is being quoted at 33 cents a lb. plus the U.S. import tax of 1·7 cents a lb., or a total cost to consumers of 34·70 cents delivered. The company reports that the dock strike on the East and Gulf coasts has cut off major sources of foreign copper-bearing raw materials from Africa and South America treated at its Carteret, New Jersey, refinery, while strikes at U.S. mines and smelters since early August have reduced supplies from this source.

LIGHT METALS STATISTICS IN JAPAN
(May, 1959)

Classification	Production	Shipment	Stock	Export
Alumina	26,628	28,119	10,188	11,846
Aluminium				
Primary	8,512	8,797	1,710	4
Secondary	3,006	2,977	393	—
Rolled Products	7,519	7,653	1,744	7 0
Electric Wire	762	1,025	816	313
Sheet Products	1,571	1,544	1,294	113
Castings	2,207	—	—	—
Die-Castings	1,291	—	—	—
Forgings	21	—	—	—
Powder	—	—	—	—
Primary Aluminium (June)	8,227	8,711	1,276	1
Sponge				
Titanium	208	174	722	154
Magnesium	131	148	152	—
Secondary	294	280	188	0

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

West Germany (D-marks per 100 kilos):

Used copper wire ..	(£205.17.6)	235
Heavy copper	(£201.10.0)	230
Light copper	(£170.17.6)	195
Heavy brass	(£118.5.0)	135
Light brass	(£91.17.6)	105
Soft lead scrap	(£56.0.0)	64
Zinc scrap	(£38.12.6)	44
Used aluminium unsorted	(£105.2.6)	120

France (francs per kilo):

Electrolytic copper scrap	(£191.2.6)	255
Heavy copper	(£191.2.6)	255
No. 1 copper wire ..	(£176.2.6)	235
Brass rod ends.....	(£127.12.6)	170
Zinc castings	(£51.0.0)	68
Lead	(£69.0.0)	92
Aluminium	(£129.12.6)	173

Italy (lire per kilo):

Aluminium soft sheet clippings (new) ..	(£200.15.0)	340
Aluminium copper alloy	(£135.17.6)	240
Lead, soft, first quality	(£79.0.0)	134
Lead, battery plates	(£44.5.0)	75
Copper, first grade	(£221.5.0)	375
Copper, second grade	(£209.10.0)	355
Bronze, first quality machinery	(£203.2.6)	345
Bronze, commercial gunmetal	(£174.10.0)	295
Brass, heavy.....	(£147.12.6)	250
Brass, light	(£237.17.6)	225
Brass, bar turnings ..	(£135.17.6)	230
New zinc sheet clippings	(£65.0.0)	110
Old zinc	(£50.2.6)	85

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Lark Bros. (Polishers) Limited (636079), 77 Portland Place, W.1. Registered August 31, 1959. To carry on the business of general engineers, metal polishers, etc. Nominal capital, £100 in £1 shares. Directors: Sidney E. Lark, Leonard G. Lark and Sidney J. W. Holt.

Gillsan Company Limited (636796), The Stables, Chapel Street, Netherton, Worcs. Registered September 10, 1959. To carry on business of manufacturers of metals springs, machinists, etc. Nominal capital, £4,000 in £1 shares. Directors, Albert Hems and Mrs. Gladys M. Hems.

Bells (Metals) Limited (636875), 3/9 Mount Vernon Road, Liverpool. Registered September 11, 1959. Nominal capital, £100 in £1 shares. Directors, William G. Bell and Mrs. B. Bell.

Metapro Limited (636942), Orchard Works, Ifield Road, Ifield, Sussex. Registered September 11, 1959. To carry on business of metal machinists, iron, steel and metal manufacturers and dealers, etc. Nominal capital, £500 in £1 shares. Directors, Chas. W. Douglas, Ronald D. J. Harris, Bernard I. F. Howard and Dennis C. B. Howard.

Prefab Metals Limited (637149), 11 Newstet Road, Kirkby Industrial Estate, Kirkby, nr. Liverpool. Registered September, 15, 1959. To take over business of sheet metal workers, panel beaters and light engineers carried on as "Prefab Metals" at Kirkby Industrial Estate, Kirkby, nr. Liverpool, etc. Nominal capital, £2,000 in £1 shares. Directors, John J. Ryan and Arnold Taylor.

Consolidated Beryllium Ltd. (637584), 9 Basinghall Street, E.C.2. Registered September 21, 1959. To produce, manufacture, fabricate, deal in and turn to account, beryllium in all its forms, etc. Nominal capital, £350,000 in £1 shares. Directors not named.

Kaiser Aluminium Company Limited (637249), Essex House, Essex Street, Strand, W.C.2. Registered September 16, 1959. Nominal capital, £100 in £1 shares. Directors to be appointed by subscribers.

Holborn Metal Works Ltd. (637336), 202-204 Bishopsgate, E.C.2. Registered September 17, 1959. Nominal capital, £100 in £1 shares. Directors: Joseph Begon, Rosa Begon and Gordon E. Linzey-Hamilton.

Wakefield and Chamberlain Limited (637371), 151 Tredegar Road, Bow, E.3. Registered September 17, 1959. To take over business of iron, steel and machinery and metal merchants carried on as "Wakefield and Chamberlain" at Bow, E.3. Nominal capital, £1,000 in £1 shares. Directors: Albert A. Wakefield and Wm. J. Chamberlain.

Cambrian Plating Company Limited (637432), 23 Dudley Street, Wednesbury. Registered September 18, 1959. To take over business of electroplaters carried on at 12 Somerset Place, Swansea, by George James and Son Ltd., etc. Nominal capital, £1,000 in £1 shares. Directors: Hendrik J. Touw and Jacob C. Wolse.

THE STOCK EXCHANGE

Turnover Well Maintained But Steels Uncertain In Tone

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 5 OCTOBER + RISE — FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1959 HIGH	1959 LOW	1958 HIGH	1958 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	27/–	9	9	6 13 3	27/4½	23/3	24/9	17/6
400,000	2/–	Anti-Attrition Metal	1/3	4	8½	6 15 0	1/6	1/3	1/9	1/3
41,303,829	Stk. (£1)	Associated Electrical Industries ...	61/3xd +1/1½	15	15	4 18 0	64/–	54/–	58/9	46/6
1,613,280	1	Birfield	58/6	15	15	5 2 6	60/–	46/9	62/4½	46/3
3,196,667	1	Birmid Industries	82/9 +9d.	17½	17½	4 4 6	83/–	72/–	77/6	55/3
5,630,344	Stk. (£1)	Birmingham Small Arms	47/3	11	10	4 13 0	48/9	36/1½	39/–	23/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/9xd	5	5	6 7 0	16/3	15/–	16/1½	14/7½
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	18/7½xd	6	6	6 8 9	18/10½	17/9	17/4½	16/6
500,000	1	Bolton (Thos.) & Sons	34/6xd +3d.	10	10	5 16 0	34/6	27/6	28/9	24/–
300,000	1	Ditto Pref. 5%	15/–	5	5	6 13 3	15/6	14/–	16/–	15/–
160,000	1	Booth (James) & Co. Cum. Pref. 7%	20/6	7	7	6 16 6	20/6	20/–	20/4½	19/–
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	20/6	6	6	5 17 6	20/7½	18/9	20/–	18/4½
17,247,070	Stk. (£1)	British Insulated Callender's Cables	54/– +2/3	12½	12½	4 12 6	57/–	46/3	52/6	38/9
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	66/6 +2/–	10	10	3 0 0	67/9	49/3	52/–	28/3
1,200,000	Stk. (5/–)	Canning (W.) & Co.	14/4½ +4½d.	25+ *2½C‡	25	4 7 0	16/–	12/3	25/3	19/3
60,484	1/–	Carr (Chas.)	2/– —3d.	12½	25	6 5 0	2/10½	1/3	2/3	1/4½
555,000	1	Clifford (Chas.) Ltd.	26/3	10	10	7 12 6	27/–	22/6	22/–	16/–
45,000	1	Ditto Cum. Pref. 6%	17/–	6	6	7 1 3	17/–	15/3	16/–	15/–
250,000	2/–	Coley Metals	3/–	15	20	10 0 0	4/–	2/10½	4/6	2/6
10,185,696	1	Cons. Zinc Corp.†	64/– +3d.	15	18¾	4 13 9	69/3	59/–	65/3	41/–
1,509,528	1	Davy & United	95/– +11/–	30‡	20	3 3 3	98/6	43/1½	87/–	45/9
6,840,000	5/–	Delta Metal	17/3xd +1½d.	31‡	30	4 9 9	18/3	12/–	25/–	17/7½
5 296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	54/9 +1/3	15	12½	5 9 6	57/6	36/7½	38/–	22/9
750,000	1	Evered & Co.	35/4½xd	10§	15D	5 13 0	35/9	30/–	30/–	26/–
18,000,000	Stk. (£1)	General Electric Co.	40/– +1/3	10	10P	5 0 0	40/6	30/–	40/6	29/6
1,500,000	Stk. (10/–)	General Refractories Ltd.	40/– +9d.	20	20	5 0 0	40/–	31/9	39/3	27/3
401,240	1	Gibbons (Dudley) Ltd.	64/4½	16½	15	5 2 6	66/6	63/6	67/6	61/–
750,000	5/–	Glacier Metal Co. Ltd.	8/–	11½	11½	7 3 9	9/3	6/7½	8/3	5/–
1,750,000	5/	Glynwed Tubes	21/9 +6d.	20¶	20	4 12 0	23/6	16/4½	18/1½	12/10½
5,421,049	10/–	Goodlass Wall & Lead Industries ...	41/– +9d.	13‖	18D	3 3 6	41/–	28/7½	30/9	17/3
342,195	1	Greenwood & Batley	105/–	30	20	5 14 3	108/3	75/–	57/9	45/–
396,000	5/–	Harrison (B'ham) Ord.	19/9 —1½d.	*17½	*15	4 9 0	20/1½	14/11½	15/9	11/6
150,000	1	Ditto Cum. Pref. 7%	19/6	7	7	7 3 6	19/6	19/3	19/9	18/4½
1,075,167	5/–	Heenan Group	11/9 +1/9	10	10‡	4 5 0	10/9	7/6	9/7½	6/9
236,958,260	Stk. (£1)	Imperial Chemical Industries ...	46/6xd +2/10½	12DZ	10	3 8 9	46/4½	33/9	38/–	24/3
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	16/9 +3d.	5	5	5 19 6	17/10½	16/–	17/1½	16/–
14,584,025	**	International Nickel	172 +¾	$2.60	$3.75	2 16 3	187½	154½	169	132½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/3	5	5	6 3 0	16/3	15/4½	16/9	15/–
6,000,000	1	Ditto Ord.	40/–	12D	10	4 0 0	44/3	29/7½	47/–	36/6
600,000	10/–	Keith, Blackman	31/3	17½E	15	4 7 0	31/3	25/–	28/9	15/–
320,000	4/–	London Aluminium	6/6 +1½c.	10	10	6 3 0	6/9	5/3	6/–	3/–
765,012	1	McKechnie Brothers Ord.	46/– +1/6	15	15	6 10 6	45/–	41/–	45/–	32/–
1,530,024	1	Ditto A Ord.	43/–	15	15	6 19 6	43/6	38/9	45/–	30/–
1,108,268	5/–	Manganese Bronze & Brass	15/6 +6d.	20⅔	20	6 15 6	16/3	13/9	14/1½	8/9
50,628	6/–	Ditto (7½% N.C. Pref.)	6/–	7½	7½	7 10 0	—	—	6/3	5/6
13,098,855	Stk. (£1)	Metal Box	63/9 +3/6	11	11	3 9 0	63/9	44/7½	73/3	40/6
415,760	Stk. (2/–)	Metal Traders	10/9	50	50	9 6 0	12/3	8/4½	9/–	6/3
160,000	1	Mint (The) Birmingham	28/–	10	10	7 2 9	28/–	22/–	22/9	19/–
80,000	5	Ditto Pref. 6%	80/–	6	6	7 10 0	75/6	69/–	83/6	69/–
3,705,670	Stk. (£1)	Morgan Crucible A	57/6 +6d.	10ϕ	10	3 9 6	58/6	43/6	45/–	34/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	17/6 —6d.	5½	5½	6 5 9	18/6	17/6	18/–	17/–
2,200,000	Stk. (£1)	Murex	52/3 +3/–	15	17½	5 14 9	52/3	41/–	58/9	46/–
468,000	5/–	Ratcliffs (Great Bridge)	12/–	10R	10	3 2 6	12/–	9/6	11/1½	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	41/–	25	20	6 2 0	41/–	27/9	27/3	24/6
1,365,000	Stk. (5/–)	Serck	24/– +3d.	15	17½	3 2 6	24/1½	18/–	18/7½	11/–
6,698,586	Stk. (£1)	Stone-Platt Industries	51/– +6d.	15	15	5 17 9	53/6	42/6	45/6	22/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	17/9	5½	5½	6 4 0	18/–	15/10½	16/3	12/7½
18,255,218	Stk. (£1)	Tube Investments Ord.	98/– +5/6	17½	15	3 11 6	98/3	72/–	86/–	48/4½
41,000,000	Stk. (£1)	Vickers	28/6xd +1/1½	10	10	7 0 3	37/–	27/4½	36/3	28/9
750,000	Stk. (£1)	Ditto Pref. 5%	15/–	5	5	6 13 9	15/0½	14/3	15/9	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	21/3 —1/3	*5	*5	6 19 0A	22/7½	20/6	23/–	21/3
2,200,000	1	Ward (Thos. W.), Ord.	101/– +1/–	20	15	3 19 3	101/9	83/–	87/3	70/9
2,666,034	Stk. (£1)	Westinghouse Brake	49/– +6d.	10	10	4 1 9	50/6	39/9	46/6	32/6
225,000	2/–	Wolverhampton Die-Casting ...	9/10½ +1½d.	30	25	6 1 6	10/6	8/8½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	28/3 —3d.	27½	27½	4 17 3	32/6	21/6	22/9	14/9
78,465	2/6	Wright, Bindley & Gell	6/7½	20	20	7 11 0	7/6	4/11½	5/4½	2/9
124,140	1	Ditto Cum. Pref. 6%	13/9	6	6	8 14 9	13/9	12/10½	13/–	11/3
150,000	1/–	Zinc Alloy Rust Proof	3/6 +3d.	27	40D	7 17 9	3/9½	2/9	3/1½	2/7½

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% Capitalized issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months. D and 50% capitalized issue. C Paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. § And Special distribution of 2½% free of tax. R And 33⅓% capitalized issue in 8% Maximum Ordinary 5/– Stock Units. ¶ Interim since increased from 10% to 12%. ϕ And proposed 40% capitalized issue. Z Interim since increased.

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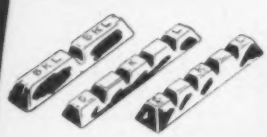
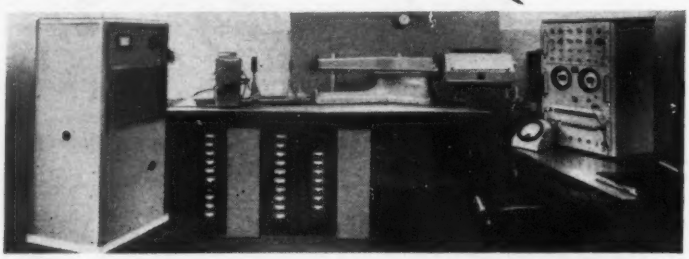
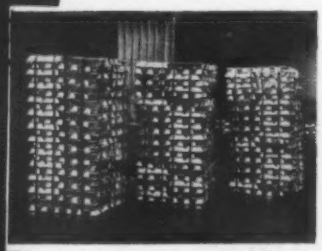


Casting Alloys *Wrought Alloys*
Master Alloys *Magnesium Alloys*
Granulated Aluminium Powder



Spectrograph at Kings Norton Works



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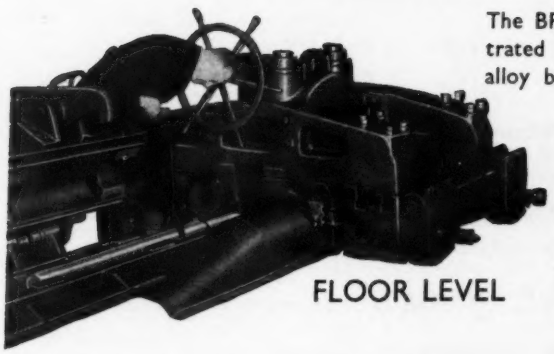

FLOOR LEVEL

The BRONX Hot Reeling Machine illustrated has capacity for 80 tons tensile alloy bars, up to 3½" dia. and as lower picture shows, is usually installed at floor level. There are other Bronx Reeling Machines with capacities ranging from 3/16" to 8" dia. bars. There are also BRONX Press Brakes, Guillotines, Plate Bending Rolls, etc.

ILLUSTRATED LITERATURE ON REQUEST

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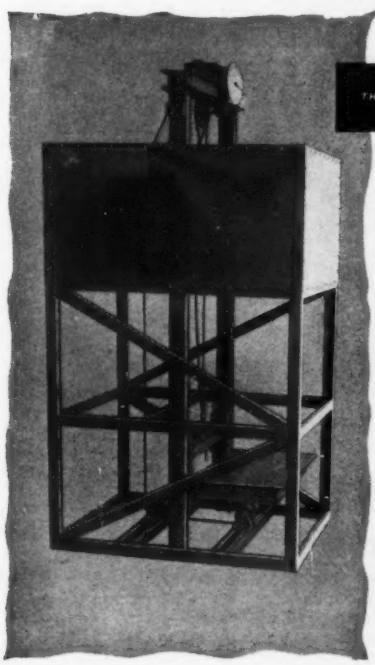
BRONX REELING MACHINE



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CASTING CAPACITY

The die moulds, each 3 in. to 4 in. long are arranged for water-cooling and are carried on a hinged table on the upper platform of the machine. Billets can be cast as follows: up to 24 in. dia. by 10 ft. long can be cast singly. Two billets simultaneously up to 15 in. dia. Four billets from 6 in. to 12 in. Six billets up to 6 in. dia. Rolling slabs from 1 to 5 according to size required.

Patent Nos.,
British
617499 - 733913 - 19288/53.
Canadian
646220
Australian
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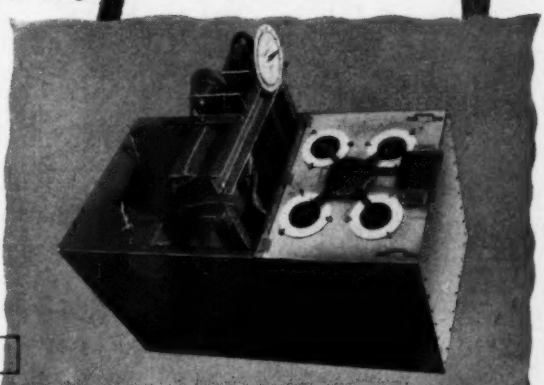

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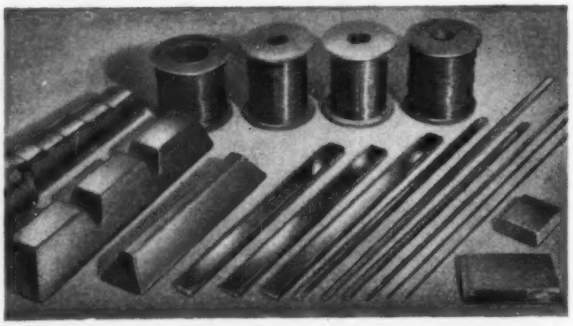

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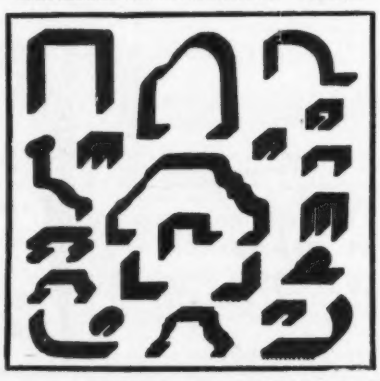
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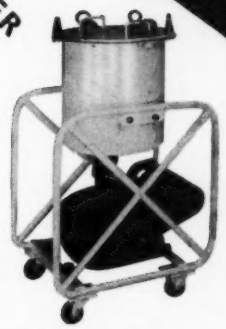

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